50TH ISSUE

The Sport and Exercise Scientist

The official publication of the British Association of Sport and Exercise Sciences

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The Sport and Exercise Scientist: The 50th anniversary issue

Dr Claire Hitchings FBASES picks out her highlights from the 50 issues.

I am delighted to be celebrating the 50th issue of The Sport and Exercise Scientist. It's strange to be forced to reflect back to September 2004 when the first issue was launched. Its predecessor BASES World wasn't financially viable and this prompted a review. It was agreed to reduce the number of reports from elected officers and focus more on articles that contributed to the CPD of sport and exercise scientists by promoting evidence-based practice. I was particularly keen to publish articles with obvious take-home messages and answered the "So what?" and "Why does this matter to sport and/or exercise scientists?" questions.

"I am delighted to be celebrating the 50th issue of The Sport and Exercise Scientist. It's strange to be forced to reflect back to September 2004 when the first issue was launched."

The Board saw lots of exciting opportunities to developing a new-style publication (its working title was BASES New World). We ran a competition with members for the new title and 'The Sport and Exercise Scientist' was chosen. I was delighted to have someone as high calibre as Dr Chris Sellars apply to be editor and he was duly appointed. The Editorial Advisory Board was of equally high quality - Lisa Board, Dr Tracey Devonport FBASES, Prof Andy Lane FBASES, Dr Sarah Rowell FBASES and Prof John Saxton FBASES. I appointed myself with the grand title of Production Director. We contracted suppliers that would make it a break-even publication. The front cover was supplied by Prof Greg Whyte OBE, FBASES capturing the Olympic and Paralympic focus. It was thrilling to finally receive a hard copy of the first issue.

Prof Andy Lane FBASES took over as editor for issue 4 (June 2005) until issue 21 (September 2009). He combined fun with getting the job done, which I really enjoyed. Then Dr Sarah Rowell FBASES became editor and she brought her amazing contact list to the fore. I took over the editor role for Issue 27 in Spring 2011. For this 50th issue I was tasked with picking my favourite six issues. Issue 1 was an obvious choice - like sharing photos of your new-born!

Issue 13 is next, showcasing Prof Jo Scurr's innovative breast research. This was one of the first sport and exercise science-related research projects that combined addressing a relevant issue and receiving considerable publicity outside of the world of sport and exercise sciences. I'd like to see more of our research being featured in the media and making a difference to the wider population.

For issue 27 we used arguably the greatest resource of BASES, the expertise of our members, to put together a physical activity for health expert panel to provide 'sound bite' suggestions on tackling childhood obesity. Dr Keith Tolfrey FBASES, Prof Marie Murphy FBASES, Prof Nanette Mutrie MBE, FBASES, Prof John Saxton FBASES, Prof Ken Fox FBASES and Prof Stuart Biddle FBASES all contributed. At the time I was kids-free but now as a mum-of-two I witness first-hand the sad reality of this issue. Can BASES members provide the desperately needed solutions that encourage a more active lifestyle and healthier diet?

Issue 36 is my favourite front cover for numerous reasons. First, it reflects the production of the BASES Position Stand on Graduate Internships, an extremely important position stand that I co-authored along with Michael Pye, Dr Lance Doggart, Prof Graeme Close and Lisa Board. It provides good practice recommendations to guide organisations towards the development of quality graduate internships. In short, it was an attempt to stop employers offering unpaid internships. It was supported by UK Sport, who arguably host the go-to place for sport and exercise science-related jobs and it meant that they would no longer advertise positions that didn't meet the guidelines. The 'model' on the front cover was a neighbour and I was the photographer; having to contain my inner Austin Powers' 'Yeah baby'.

Next is issue 40, the publication of the BASES Position Stand on Curriculum-based Work Placements written by Lisa Board, Edward Caldow, Dr Lance Doggart FBASES, Dr Zoe Knowles FBASES, Michael Pye and Dr Craig Twist. This was requested by attendees at the BASES Heads of Department Forum, an extremely successful and important annual event, and it was satisfying to see the journey from the request to the final publication.

Then, finally issue 46, which featured Athena SWAN by Dr Tracey Devonport FBASES. Athena SWAN is intended to encourage and recognise commitment to advancing careers of women in Universities and Colleges in STEMM subjects; an initiative BASES and I fully support. I love the swan-shaped 'word cloud' we created for the front cover.

Thank you for indulging me in this reflective look back on the past 50 issues. Thanks also to the former editors, the Editorial Advisory Board and all the contributors who have made the Sport and Exercise Scientist what it is today. Here's to the next 50 issues. ■

Dr Claire Hitchings FBASES

Claire is the Editor of The Sport and Exercise Scientist and the BASES Executive Director.

Contents

The Sport and Exercise Scientist
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Sports and Exercise Nutrition Register (SENr) supplement use in sport position statement

endorsed by

The following position statement was written under the guidance of the SENr board, with specific technical contributions from Prof Graeme L Close FBASES, Michael Naylor and Irene Riach.

Introduction
With elite sport becoming increasingly more competitive, athletes and teams are constantly looking for ways to gain an edge over opposition. This has led to nutritional supplement use becoming common practice for many athletes. Analyses conducted following the Atlanta and Sydney Olympic Games revealed 69% and 74% use of supplements by Canadian athletes respectively (Huang *et al.* 2006) and a study showed that 85% of elite track and field athletes report use of supplements (Maughan *et al.*, 2007). At the FIFA 2006 World cup 57% of players reported use (Tscholl *et al.*, 2008) and at the London 2012 Olympics 82% of Japanese athletes used supplements in the year before the games (Sato *et al.*, 2015).

Evidence suggests that the rate of contamination of supplements widely available to purchase in the UK, Europe and USA is between 10 and 25% (HFL, 2013). This is confirmed by the UK Anti-Doping (UKAD) figures which indicate that approximately 44% of positive tests in the UK in 2012 are thought to have been attributed to the presence of prohibited substances in supplements (source UKAD).

It is important to note the difference between a prescribed pharmaceutical grade supplement i.e. Vitamin D or Ferrous Sulphate and that of an over the counter Vitamin D or Iron preparation. The pharmaceutical grade supplement will carry less risk due to the rigors of production as a medicine. Practitioners should be mindful of nutritional deficiencies as identified by haematological investigation and the importance of appropriate intervention via a prescribed pharmaceutical grade supplement.

British athletes are governed by the UK Anti-Doping rules (http://www.ukad.org.uk/resources/document/uk-anti-doping-rules) and the World Anti-Doping Code (https://www.wada-ama.org/en/resources/the-code/world-anti-doping-code), both of which are underpinned by the principle of "Strict Liability". This means that each athlete is solely responsible for any prohibited substance found in their body regardless of how it got there and whether there was any intention to cheat. A positive test is just one way to commit an anti-doping rule violation (ADRV), the consequences of which will be determined by the athlete's degree of fault and their intentions. The principle of 'Strict Liability' is particularly relevant where nutritional supplements are concerned, as the risk of inadvertently consuming prohibited substances is higher compared with consuming food.

When used effectively and safely, some supplements may contribute towards improvements in health and/or performance for some athletes. This may be by supporting adaptation to training, supporting immune function or injury prevention/management, or by having a direct performance enhancing effect. However, due to the nature of the supplement industry, there are potential risks, which may lead to an anti-doping violation, such as inconsistencies in production standards and sourcing of ingredients. Furthermore, many products available for everyday purchase contain prohibited substances.

Purpose
The aim of this position statement is to provide Athlete Support Personnel (ASP) with a guide to appropriately assess the need for supplementation, assess the risk of supplementation, understand the consequences of taking supplements from an anti-doping perspective and provide practical guidelines and tools for the safe usage in order to support athletes and ASP. This document should be read in conjunction with the SENr Clean sport commitment in Appendix Four on the position stand, available: www.senr.org.uk/about/key-documents/

Legislation and World Anti-doping code
The World Anti-doping Code clearly states that ASP must be knowledgeable and comply with all anti-doping policies and rules. ASP should be aware that they could be sanctioned for six out of the ten Anti-Doping Rule Violations (ADRV) in the World Anti-Doping Code. ASP are encouraged to use their influence positively, help develop ethical behaviour, strong values and foster anti-doping attitudes amongst the athletes that they work with.

It is important that all members of the SENr have a clear understanding of the present risks associated with advising consumption of supplements. UK anti-doping (UKAD) gives a clear warning that recommending the use of nutritional supplements could put ASP at risk of an ADRV. The 2015 World Anti-Doping Code (2015 Code) has included two new ADRVs which are applicable to ASP;

Complicity
ASP found to be involved in assisting or covering up an athlete's ADRV can now be sanctioned in the same way as the person who has committed the ADRV. ASP who engage in conduct which he or she knew constituted an ADRV, or knew that there was a significant risk that conduct might result in an ADRV and manifestly disregarded that risk, may be found to have intentionally committed a doping offence. The sanction from 1 January 2015 for intentional doping is four years of ineligibility to practice in sport.

Prohibited association
If you are an ASP who has either been found guilty of an ADRV or a criminal or disciplinary offence equivalent to an ADRV (such as providing banned substances), you will be required to inform UKAD and SENr alongside any athletes or sports you are currently working with. Athletes should be reminded of strict liability and that any athlete may face a ban of up to two years if they continue to work with a banned ASP after notification.

Other points to note
ASP are not allowed to use or possess any banned substances unless for a valid medical reason. If an athlete you support who is a minor is found to have committed an ADRV, or if more than two athletes you work with have committed an ADRV, you may also be investigated by UKAD.

As of October 2015, UKAD have published an online list of ASP found guilty of an ADRV, some with life bans on working in sport.

If an athlete is found to contravene the 2015 Code and fails a doping test which they believe is due to contaminated products, it is the responsibility of the athlete to provide evidence that:
The product was contaminated

- They have undertaken due diligence before taking the product i.e. was the product tested and part of a programme such as Informed-Sport.

Thus, whilst the legal responsibility falls to the athlete themselves, a key role of the ASP is to ensure that comprehensive and up to date advice is provided to the athlete and the wider team. It is therefore imperative that the ASP is aware of all updates to the Prohibited List. The Prohibited List as a minimum is updated annually with changes coming into effect on 1 January each year, although the List can be updated at any time. It should be noted that there is a three month advance notice period of any changes to the List, alongside any associated developments within the World Anti-Doping Code. SENr strongly advise their members to ensure they are up to date with any wider legislation relating to the production or manufacture of supplement products.

Key points for consideration and application

- Reported contamination rates of nutritional supplements currently sits around 10-25%.
- 44% of positive tests in the UK in 2012 are thought to have been the consequence of prohibited substances in supplements.
- Supplement producers conform to different manufacturing standards than the production of pharmaceutical medicines. Supplements which have been batch tested help to minimise the risk, an example of a batch testing programme is Informed-Sport.
- British Athletes are bound by the principle of Strict Liability within the World Anti-Doping Code.

Is supplementation necessary?

Athletes are constantly surrounded by marketing and pressures from peers and ASP to consider supplement usage for a performance edge. The main risks associated with supplements are; the product contains prohibited substances, contamination to the raw ingredients, cross contamination in the manufacturing process ingredients not listed on the label or labelled under a different name and the risk of buying a counterfeit product, particularly when purchased online. It is essential that athletes and ASP effectively 'assess the need' for supplements prior to use. As with any intervention in sport the decision to use supplements should stem from a health or performance question, not a marketing claim. Adopting such a 'performance backwards' approach addressing performance and/or health questions empowers strategies to be relevant, specific and individualised.

Nutrition solutions should be constructed with a 'food first' mind-set to avoid the use of any unnecessary supplements which may increase the risk of committing an ADRV. It is proposed that the most suitable support personnel to advise on supplement use are those who are registered with a suitable accreditation body (e.g. SENr). Such practitioners have had to demonstrate an understanding of appropriate supplement usage and safety as part of their registration process.

In many cases performance questions should not be the only pre-determinant of supplement usage. Relevant biomarkers which indicate nutrient deficiencies (e.g. blood data) are often of benefit, not only to highlight a deficiency, but to ensure supplements are taken in safe doses and that levels of toxicity are not reached to avoid adverse health and performance effects.

Key points for consideration and application

- Consideration of supplement use should stem from performance/ health questions, not marketing claims i.e. a performance backwards approach.
- Adopt a 'food first' philosophy, not supplement first, to maximise safety and relevance.
- Athletes and practitioners should seek advice from suitably qualified and registered practitioners (e.g. SENr).
- Utilise relevant biomarkers where possible to assess the need of supplements, and monitor effectiveness and safety of strategies.
- When supplements are utilised, interventions should be monitored to assess the effectiveness. This can be achieved by assessing relevant health or performance biomarkers along with athlete feedback.

Product identification

With the large number of supplements available, and the UK market being valued at circa £300 million in 2013, maximising profit is often the primary objective of many supplement companies. It is important to be aware that pharmaceutical manufacturing standards are tightly regulated whereas the supplement industry is regulated differently. As a consequence, athletes must undertake thorough research of any supplement product that they intend to use to minimise their risk of inadvertent doping.

With research suggesting at least 10% of supplements contain traces of prohibited anabolic steroids and/or stimulants from leading European Sports Brands (HFL, 2013), athletes may be regularly exposed to supplements that may be capable of committing an ADRV. To reduce the risk of inadvertent doping, supplement testing schemes such as Informed-Sport have been developed to batch-test products for prohibited substances, in accordance with the WADA Prohibited List (http://list.wada-ama.org/). All products used by athletes should be batch-tested for prohibited substances using a risk minimisation scheme such as Informed-Sport (www.informed-sport.com/).

It is not only contaminants that pose a risk to athletes, it has been suggested that many supplements contain ingredients listed on the product label under a variety of different names. Therefore, it is recommended to purchase from suppliers who manufacture to Good Manufacturing Practice guidelines (GMP), are certified to ISO9001: 2008 by SGS, a United Kingdom Accreditation Service (UKAS) accredited company, and independently audited on a regular basis. The purpose of such process is to have all ingredients traceable back to source. It is therefore important to acknowledge that GMP was not developed with risks of banned substances in mind and is not a replacement for screening for contamination. Furthermore, due to the varying quality of products on the market it is often beneficial for practitioners and athletes to do their own research into product quality and traceability. If the company cannot provide details of ingredient traceability and quality then it may be worth considering alternative products.

Key points for consideration and application

- Ensure products are batch-tested for prohibited substances to reduce the risk of contamination (e.g. Informed-Sport)
- Use products from suppliers who manufacture to GMP standards
- Research traceability of products to ensure ingredients are from quality sources and manufactured to the highest standards.

Practical advice

Recognising that athletes will seek advice, ASP should take significant caution when offering advice, taking steps to protect athletes and themselves. The flowchart in Figure 1 is suggested as a useful reference tool to guide discussions with athletes.

SENr registrants should be considered a vehicle of information given their understanding and practical experience in this field. Registrants can support athletes to make this informed decision by following the UKAD approach of:

- Assess the need (i.e. is the gap in performance nutrition related)
- Assess the risk (is the supplement batch-tested, is it on Informed-Sport

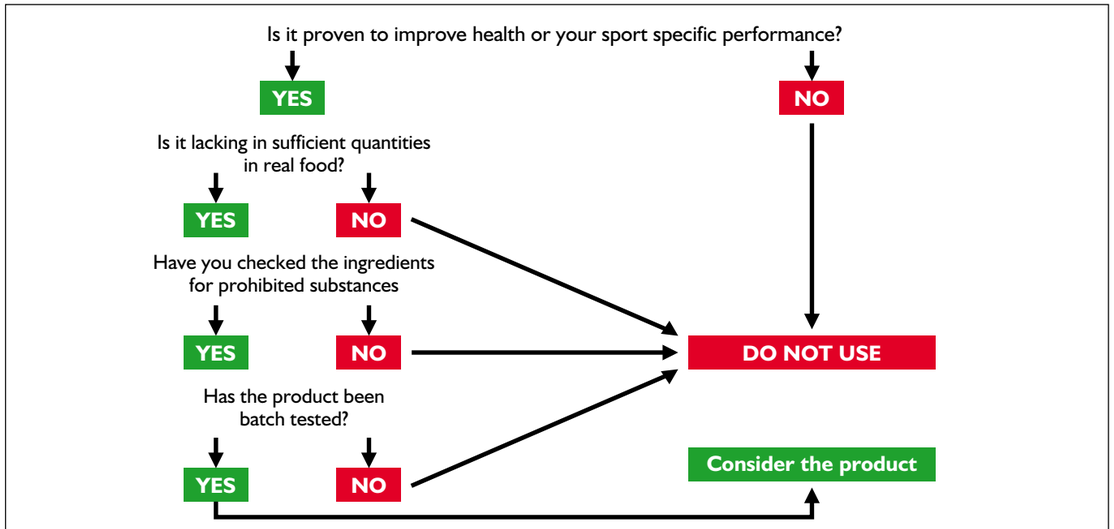

Figure 1. Supplement decision-making flowchart

- Assess the consequences (4 year ban from sport, loss of income from sponsors, removal from training group, loss of reputation, impact on friends and family).

If after careful consideration of the above points, the athlete wishes to use a supplement the ASP must carefully document this discussion and actions arising as this could form part of their defence should an ADRV occur. Please refer to the SENr guidance on record keeping which is aligned to data protection, however SENr would recommend that athlete records are kept for a minimum of 10 years in line with retrospective anti-doping testing protocols.

Current thinking on best practice of supplement procurement entails an evidence trail of the research carried out by the athlete. Careful checking that the supplement intended is present on the Informed-Sport website and that the batch purchased has a valid Informed-Sport certificate. This certificate should be stored electronically or in paper format for 10 years.

NB: It is crucially important that this risk assessment is carried out for each new batch of products purchased to ensure that the athlete is protected. See Appendix 2 of the full position statement available: www.senr.org.uk/about/key-documents/

Once the product arrives it is important to check that the batch certificate matches the supplement purchased. A sample of each batch tested product is stored by the anti-doping laboratory LGC for the shelf life of that particular batch. It is then the athlete's choice whether to keep a sample of the batch tested supplement longer if deemed necessary, bearing in mind that retrospective anti-doping testing of blood or urine can be carried out for a period of up to 10 years post collection. It is very important that if supplements have been identified as part of the needs assessment, that clear measures of impact are identified before the supplementation is commenced. Without this there will be no way to verify whether the supplement has had a positive or negative impact on performance. This should be recorded in practitioner notes as part of good practice guidelines. It is also worth considering the use of a disclaimer with athletes to ensure that 'strict liability' is fully understood by the athlete. An example disclaimer can be seen in Appendix 3 of the full position statement available: www.senr.org.uk/about/key-documents/

Key points for consideration and application

- ASP should exercise caution when offering advice on supplements to athletes and coaches, and should take steps to protect themselves and the athlete they are supporting
- SENr practitioners can provide advice to enable an athlete to make an informed decision in the area of nutritional supplements and food intake
- SENr practitioners should pay particular attention to the SENr guidance on note taking for best practise examples, as these notes may be used as evidence in the event of an ADRV. ■

Irene Riach

Irene is the Senior Performance Nutritionist at the sportscotland institute of sport, a HCPC registered Dietitian, High Performance Registrant on the Sport and Exercise Nutrition Register (SENr) and sits on the SENr board.

Michael Naylor

Michael is a Lead Performance Nutritionist for the English Institute of Sport providing technical supervision to practitioners and leading the nutrition partnership programme. He is a High Performance Registrant on the Sport and Exercise Nutrition Register (SENr) and member of Professionals in Nutrition for Exercise and Sport (PINES).

Prof Graeme L Close FBASES

Graeme is Professor of Human Physiology at Liverpool John Moores University. He is accredited with the UK Strength and conditioning Association (UKSCA), he is a BASES accredited sport and exercise scientist and is on the Sport and exercise Nutrition register (SENr) where he also serves on the executive committee.

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News

BASES Annual Report available for download

The Board has pleasure in presenting its annual report (September 2015-August 2016) and the financial statements of BASES for the year ended 31 March 2016. The Board report is contained within The Sport and Exercise Scientist for easy viewing. Download a PDF of the full annual report and financial statements: www.bases.org.uk/Publications-Documents-and-Policies

BASES Annual General Meeting

All BASES members are invited to the 2016 BASES Annual General Meeting (AGM) on Tuesday 29 November 2016 at (17:30-18.30) at the East Midlands Conference Centre. This is your opportunity to meet the Board and contribute your views and ideas.

Katy Spink joins the BASES team as Office Manager

Katy Spink joined the team in September as Office Manager, a role she shares with Jane Bairstow. Jane's working hours are 09:00-17:00 on Monday and Tuesday and 09:00-14:00 on Wednesday. Katy works 12:00-17:00 on Wednesday and 09:00-17:00 on Thursday and Friday. Katy has a background in providing high level administrative support for a regional building society and also has many years' experience as a charitable trustee.

Revised Re-Accreditation Scheme

Following on from member feedback, and as part of a full accreditation review, we have updated the Re-Accreditation paperwork. This was trialled with a number of members in July and reviewed by the Accreditation Committee in September. With some minor amends, there will be a full roll out of the new system in January for anyone applying for re-accreditation. Please see page 24 for further details. All new documentation can be found on the BASES website: www.bases.org.uk/Re-Accreditation

Human Kinetics online courses endorsed by BASES

BASES is excited to announce that as part of our continued partnership with publisher Human Kinetics, we are now offering 13 BASES endorsed CPD courses. BASES members are required to complete a minimum of 75 hours CPD for re-accreditation, including obtaining 20 BASES credits. With these courses available online, members can enhance their knowledge and skills at their own pace. Courses feature interactive elements, online videos and tests for a rich learning experience. They cover a variety of topics including physiology and nutrition, biomechanics, psychology, sport and performance and physical activity for health with prices from £22.99. To find out more visit: http://www.bases.org.uk/hk-online-courses

Premier League sport scientists now required to be BASES accredited

BASES is pleased to announce it has developed a successful partnership with the Premier League resulting in changes to the Premier League's Rulebook, which now states that sport scientists within their Academies should be BASES accredited. We are delighted that the Premier League chose to introduce BASES accreditation as the professional standard and an essential requirement for employment in their field. It highlights that BASES accreditation is being recognised as the benchmark system within the sport and exercise sciences arena. We look forward to continuing our work with the Premier League to improve the quality and development of their staff.

New website for the BASES member mobile app library

BASES has been working closely with Our Mobile Health since they partnered in 2015 to deliver a mobile app library for BASES members helping them to find high quality apps relevant to their field, read their reviews and become part of the panel of reviewers. A new website has been launched following testing, use and feedback by BASES members. The new site has a more modern look and provides greater functionality. Apps are reviewed by BASES members and published reviews are based on a series of questions to ensure that they meet the needs, policies and safety standards that BASES members expect and look for.

BASES Fellowship

The number of BASES Fellowships awarded has reached the milestone of 100. BASES fellowship recognises esteemed professional achievement, skills, knowledge and service to BASES and the sport and exercise science community made by BASES professional members. Ten fellowships were awarded in 2016 to Dr Stuart Beattie, Prof Colin Boreham, Dr Peter Brown, Prof Ian Campbell, Dr Stewart Cotterill, Dr Claire Hitchings, Prof Louis Passfield, Dr Charles Pedlar, Dr Paul Smith and Prof Keith Stokes.

BASES Re-Accreditation and Accreditation

Laboratory Re-Accreditation

The laboratory at EIS/Loughborough Performance Centre has been BASES re-accredited

BASES Undergraduate Endorsement Scheme

The following course has been endorsed by BASES: Science and Football BSc (Hons) - Liverpool John Moores University

The following courses have been re-endorsed by BASES:

Sport and Exercise Science BSc (Hons) - Coventry University and Sport and Exercise Science BSc (Hons) - University of Worcester.

Re-Accreditation

Dr Jo Corbett, University of Portsmouth, Dr Audrey Duncan, University of Dundee, Dr Barry Fudge, British Athletics, Dr Ann-Marie Gibson, University of Strathclyde, Dr Andrew Hooton, University of Derby, Prof Andrew Lane, University of Wolverhampton, Simone Lewis, Premier League, Dr Paul McCarthy, Glasgow Caledonian University, Jo Maher, Reaseheath College, Dr Alison Maitland, Lane4Management, Prof Marie Murphy, University of Ulster, Elliott Newall, English Institute of Sport, Rhona Pearce, Loughborough University, Gareth Picknell, UAE Armed Forces, Dr Roger Ramsbottom, Oxford Brookes University, Dr Chris Sellars, University of Wolverhampton, Sion Thomas, University of Greenwich, Matthew Thombs, Julie York.

Accreditation

Laurence Birdsey, Sport Wales, Matthew Cook, University of Chichester, Dr K Hicks, Northumbria University, Laura Houghton, Edge Hill University, Prof Kevin Lamb, University of Chester, Carla Randall, University of Brighton, Dr Mark Ross, Edinburgh Napier University, Dr Georgina Stebbings, Manchester Metropolitan University, Gavin Thomas, University of Worcester, Laura Wade, Nuffield Institute.

Letters

RE: The anti-gravity treadmill

I read the article on the anti-gravity treadmill with great interest to see whether there is some consensus on its best use. During my time working in professional football I saw one used regularly both as a precaution in those with knocks and niggles as well as playing a core role in long-term rehabilitation programmes. I felt that the theory made sense to protect the joints and injured tissue while improving aerobic capacity in a more applicable mode than cycling - the more common method. In my role teaching clinical rehabilitation I wonder what the application of such a piece of equipment might be in more clinical populations after procedures such as lower limb arthroplasties. Research in recent years have started to put a focus on the benefits of early weight bearing programmes, especially in younger patients, rather than isolation used in more conservative, conventional programmes. Could this be a method to return patients to early un/semi-supported walking exercise? Dr Doggart and his colleagues reported the users "… enjoying the experience, gaining confidence in their functional movement of the injured lower limb" after using the apparatus. Some of the key goals of any rehabilitation. My main query would be whether it would be as effective as in a normal gravity condition on proprioceptive and neuromuscular training. An interesting read and an exciting area for research!

PHILLIP HERITAGE,
ANGLO-EUROPEAN COLLEGE OF CHIROPRACTIC

RE: Much to do about everything! A commentary on cross-disciplinarity in sport (and) psychology by Dr Charlotte Chandler

Seligman's "Good, Not Good, Not Good Enough" quotation is my favourite and apt in the setting of BASES/BPS training routes. I commend the view that BASES is not competing because it doesn't hold the minimal qualification for employment (HCPC), without this rubber stamp of approval it resembles a costly pyramid scheme to help neophytes gain an opportunity to financially progress towards a BPS HCPC route. Regardless, the process of completing supervision in either pathway with reflections etc. cannot ever demonstrate competence. Why is it that GP's and Strength and conditioning coaches (UKSCA) can be assessed as competent in action and demonstrating skills. If a practitioner reaches the "does" stage there could be an assessment as opposed to a historical account of their dogmatic route. The production of a portfolio or the ability to construct academically styled reports and references has little impact on applied practices. Does the dogma of academia overtly influence the type of practitioner that can be developed? I would be interested to know how many of those who in positions of power/influence in BASES actually have or are capable of running an applied practice as a sole form of income vs those who flirt with applied practice while secure in academic roles. I see no evidence in the training of BASES SE that allows or pushes for such a needed competency of actually earning money. As Jones (2009) points out that to not market and be successful while qualified is unethical because it allows unqualified and uneducated to flourish and potentially harm the field or clients. I find it hard to not compare BASES/BPS to pyramid schemes for practitioners when it doesn't meet the applied needs, assesses the route and not arrival at the destination, or strike off those who dabble in non-evidence based practice (NLP).

HUGH J. GILMORE

Write the Letter of the issue and win a year's free BASES membership. For a prize to be awarded there needs to be at least three publishable letters. Letters, which may be edited or shortened for reasons of space or clarity, should be no longer than 250 words, must refer to an article or letter that has appeared in the last issue, and must include the writer's name.

Please e-mail **chitchings@bases.org.uk** by **Tuesday 4th October**

Diary dates

2016

29-30 Nov. BASES Conference 2016, East Midlands Conference Centre, Nottingham

30 Nov. BASES Applied Practitioner Awards submission deadline

5-7 Dec. 7th Global Dieticians and Nutritionists Annual Meeting 2016, Philadelphia, USA

7 Dec. BASES Webinar: Stress and coping unpacked: exploring the myths, mysteries and magic of coping, 15:00-16:00 GMT

12-13 Dec. BPS's Division of Sport and Exercise Psychology annual conference, Cardiff

30 Dec. BASES Masters Dissertation of the Year Award submission deadline

2017

6 Jan. BASES Accreditation submission deadline

24-26 Jan. The 2017 Sports Science Summit, London

31 Jan. Professor Tom Reilly Doctoral Dissertation of the Year Award submission deadline

15 Feb. BASES Webinar: Assessment of Movement Quality: panacea or false dawn? 15:00-16:00 GMT

22 Feb. BASES workshop: We all look but do we see? Using observation in applied sport psychology, St Mary's University, London

8 Apr. BASES Supervised Experience Submission deadline

12-13 Apr. BASES Student Conference 2017, University of St Mark & St John, Plymouth

28-29 Nov. BASES-FEPSAC Conference 2017, East Midlands Conference Centre, Nottingham

Further information:
www.bases.org.uk • Events • Awards • Grants

Dr Keith Tolfrey FBASES

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BASES Conference 2016 overview

Dr Keith Tolfrey FBASES - Chair of the British Association of Sport and Exercise Sciences

On behalf of the British Association of Sport and Exercise Sciences, welcome to BASES Conference 2016. Looking at the programme, I am confident that all of our presenters through keynotes, lectures, symposia, posters, and free communications will deliver an exciting, cutting-edge BASES Conference that will live long in the memory and challenge the very best conferences we have staged since our inception in 1984.

Thank you to our official partner, the GSK Human Performance Lab; a world-class science facility focused on discovery and applied research. We are also delighted to have Renew Health Limited as an official platinum supporter; and COSMED and Cyclus2 as official gold supporters.

Each day is packed with content and insight, with a great variety of topics and presentation formats. The Scientific Programme Committee, chaired by Prof Clyde Williams OBE, FBASES has selected expert speakers to deliver the most important and impactful content. I extend a special welcome to our international invited speakers Prof Mai Chin A Paw from VU University Medical Center, Amsterdam and Prof David Bishop from Victoria University, Melbourne. Opportunities for socialising and networking play a key part in this event. I hope you will renew acquaintances and make new friends. To facilitate this, we have deliberately scheduled plenty of breaks and extended lunch periods. Day 1 will finish with the conference dinner, which welcomes guest speaker Micky Yule, a British para-powerlifting athlete.

I would like to extend a sincere thank you to all of our exhibitors. The Banqueting and Exhibition Suite will house the exhibitors, refreshments, posters and delegate social and networking activity, making it the place to be at our flagship event.

Five prestigious awards will be contested by presenters at this year's conference. These awards seek to reward outstanding contributions to sport and exercise sciences by BASES members. We are very grateful to the award sponsors: Cranlea, Human Kinetics, Routledge and Sportesse.

I take this opportunity to thank the following individuals who have played a key role in BASES Conference 2016 - Dr Claire Hitchings FBASES and Prof Clyde Williams OBE, FBASES.

Thank you all for being part of BASES' most important annual event. I hope you take the time to share your extensive knowledge and wisdom with other delegates, enjoy the experience and leave feeling inspired and energised.

BASES 2016 Conference

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New health and performance science insights from the GSK Human Performance Lab

The GSK Human Performance Lab (HPL) is delighted to be supporting the BASES annual conference for the third year running. As principal sponsors of the event, we look forward to welcoming you at Nottingham's East Midlands Conference Centre on the 29th and 30th of November. Please visit our stand and speak to members of the HPL team to hear more about our novel research in inflammation and movement, protein and digestive health, as well as cold symptoms and motivation.

Through our research and innovation facility based in Brentford, UK, the GSK HPL is committed to providing access to cutting edge research and development through our online Science Community.

The GSK HPL Science Community provides exclusive opportunities to attend our events and network with other professionals, gain access to our science and research and stay in touch with the latest expert opinion on prominent health and performance topics.

Currently available on the GSK HPL Science Community website:

Symposium: The impact of movement on health, performance and pain
This symposium explored the scientific background and practical considerations of movement and its role within maturation, elite performance and pain. There was an impressive line-up of expert speakers presenting on subjects including: the importance of instilling good movement patterns in children, measures to detect injury risk and symptoms of pain, optimised movement in performance and types of pain that effect or are affected by movement. This impressive panel included HPL Senior Scientists Paul Smith and Dr. Phill Bell, as well as Matt Portas, James Wild and Stuart Elwell.

HPL Podcast Series
The GSK Human Performance Lab podcast series is hosted by members of the GSK HPL team, exploring prominent areas of research at the HPL, including cognition, movement, physiology, nutrition and digestive health and how these impact and support innovation for GSK Consumer Healthcare. We will also share exclusive insight into our novel and innovative work and discuss and provide comment on important developments within the HPL's fields of expertise and research.

Alison Patrick and guide Hazel Smith (GBR)
Courtesy British Triathlon

Paralympic debut for triathlon in Rio 2016: the thermoregulatory challenges and applied sports perspective

Ben Stephenson and Prof Vicky Tolfrey FBASES describe the thermoregulatory challenges and provide an applied sports perspective.

The inclusion of paratriathlon in Rio this year marked a huge step forward for the sport and ParalympicsGB as a team of 11 British athletes and two guides aimed to follow in the footsteps of Vicky Holland and the Brownlee Brothers' success just weeks earlier in Rio. The goal for the paratriathlon team was to become the first ever Paralympic medallists in their respective categories (see Table 1) as the sport made its debut on Copacabana Beach.

Table 1. Paratriathlon competition categories and example impairments

Category	Impairment
PT1	Wheelchair users. Require handlers for water exit plus the use of handcycle and racing wheelchair
PT2	Ambulant athletes with severe impairment to muscle power or range of motion. May require adaptations to bicycle or use of prostheses.
Pt3	Ambulant athletes with moderate impairment to muscle power or range of motion. May require adaptations to bicycle or use of prostheses.
PT4	Ambulant athletes with mild impairment to muscle power or range of motion. May require adaptations to bicycle or use of prostheses.
PT5	Total or visual impairment. Require the use of able-bodied guide and tandem bicycle

The race was contested over the triathlon sprint distance, typical of paratriathlon events (750 m open water swim, 20 km cycle or handcycle and 5 km run or wheelchair race) and held over the first weekend of the Games. Saturday saw the British men's team do battle across three race categories, PT1, PT2 and PT4, under conditions of around 25ºC. Andy Lewis became the first British paratriathletes to win a medal at the Paralaympic Games with a dominant performance to win gold in the PT2 category. Lewis lost his leg in a motorcycle accident and competes with a prosthetic.

The following day Britain's women competed as temperatures rose to 31ºC, but these were conditions that they had prepared for. Lauren Steadman won PT4 silver whilst visually impaired athletes, Alison Patrick (guided by Hazel Smith) and Melissa Reid (guided by Nicole Walters) won silver and bronze medals.

The Peter Harrison Centre for Disability Sport (PHC), which is located at Loughborough University, where British Paratriathlon provides an Elite Training Hub, has a wealth of experience in the field of Paralympic sport. Since 2013, the PHC has adopted an embedded scientist approach under Professor Vicky Tolfrey's guidance with MSc placements and more recently with a co-funded PhD. I was fortunate to be one of these students, now registered for my PhD exploring paratriathlon from a physiological perspective whilst elucidating the transferability of research findings from able-bodied endurance sports to paratriathlon. This embedded scientist approach allows the translation of applied research findings to guide coach and practitioner delivery on the ground to directly support athlete performance and it has widened my vocational skills two-fold in just the last 10 months, with supporting the athletes in Lanzarote, attending a ITU Paratriathlon Event in Besançon and spectating in Rio, watching Lewis secure Britain's 13th of 64 gold medals.

My work initially focused on the longitudinal and acute responses to training loads from a mucosal immunity perspective (specifically salivary secretory immunoglobulin A - sIgA), but recently I have been studying strategies to optimise athletes' performance in the heat. As a scientist, it is common knowledge that hot and humid weather conditions provide a challenging environment for prolonged athletic performance (Galloway & Maughan, 1997), as became globally evident with the much seen video footage of Alistair Brownlee helping his brother Jonny over the finish line in the dramatic World Series finale in Mexico in September. However, the debilitating effects of high ambient temperatures and humidity may be further exacerbated in Paralympic athlete populations. Athletes with spinal cord injuries have a well-documented impairment in thermoregulation below their lesion level (Griggs *et al.*, 2015) whilst there are possible challenges for amputees due to altered surface area:body volume ratio and prosthetic liners limiting heat loss. Further, athletes with cerebral palsy or other neurological conditions may suffer from greater heat production during exercise due to movement inefficiency thus may be at heightened risk of performance impairment in challenging environments. Thus it is pertinent for those working with athletes to consider the competition environment to ensure athletes are best prepared for their sporting event. Although it was winter in Rio, the challenge was to prepare the paratriathletes for the likely event that the race conditions would be hot and that they would be racing at a high intensity for 60 to 70 minutes.

One such strategy that can be used is a form of heat adaptation, whether it be via artificial heat exposure (heat acclimation) or natural heat exposure (heat acclimatisation). Both consist of repeated exposure to hot environments, to raise core and skin temperature, and result in several adaptations that permit greater heat tolerance and performance maintenance. Common responses to heat adaptation are: lower core and skin temperature; plasma volume expansion; greater stroke volume and lower heart rate for a given absolute exercise intensity; enhanced sodium, potassium, chloride and fluid retention; enhanced sweat rate and threshold for sweating onset; enhanced skin blood flow and threshold for cutaneous vasodilation; attenuated carbohydrate metabolism; and perceptual alterations such as lowered ratings of perceived exertion or thermal strain. Typically to achieve these responses it has required athletes exercising at a set workload, or even a set core temperature (termed controlled hyperthermia), over 5-14 consecutive days often at a moderate intensity (Garrett *et al.*, 2011). However, at an elite level, many athletes only use heat adaptation protocols in the build-up to competitive performance to minimise the disruptive effect of the environment. Thus frequently employed heat acclimation strategies have the potential to interfere with common tapering strategies typified by reduced low-moderate intensity training. Hence alternative methods may be beneficial to maintain training intensity whilst still providing a stimulus for heat adaptation.

A novel method that we explored this year with members of the Great Britain Paratriathlon team is a mixed active and passive heat acclimation protocol. Passive acclimation, in the form of ambient heat exposure immediately after exercise, draws on work from Zurawlew *et al.* (2015) where heat adaptation was shown by six days of hot water immersion post-exercise. Whilst active acclimation sessions, in attempt to provide a more practical alternative to controlled hyperthermia protocols, were heart rate controlled thus minimising the need to continually measure core temperature. This protocol was conducted over 8 successive days and contained three passive heat exposures, immediately after training sessions whereby athletes core and skin temperature were already elevated. This was designed to have minimal impact on athletes' pre-competition routines that exercising in the heat every day may have, which is especially relevant in a multi-modality sport such as paratriathlon.

Reflective practice

This protocol resulted in positive adaptations typical of more traditional heat acclimation methods (lower core and skin temperature for a set workload, plasma volume expansion and perceptual improvements) irrespective of athlete impairment. It is in my belief that, whilst no direct performance measures were assessed, to minimise training disruption, it is likely that those athletes who underwent heat acclimation prior to the Games received a performance benefit. I may have played only a small part in the heat acclimation preparation strategy of the athletes prior to their departure to Brazil, since the athletes also attended the ParalympicsGB holding camp in Belo Horizonte. It is evident that the British Paratriathlon coaches and practitioners have developed a strong cohesive unit, led by Jonathan Riall and Brendan Purcell. Both Vicky and I have respected their knowledge and adopted an integrated sport science approach behind the scene. It was pleasing to see that Britain came second in the triathlon medal table behind the USA and ahead of the Netherlands, with 1 gold, 2 silver and 1 bronze. We hope that these performances set the foundation continuing into Tokyo 2020.

My PhD research aims to challenge the able-bodied theory-based knowledge and answer problems related to the applied setting in a systematic manner (Barlow *et al.*, 1984). This is just one example of how current research in sport and exercise science can be transferred and applied to Paralympic athletes for performance benefits. Given the relative infancy of paratriathlon at an elite level, it is difficult not to get distracted by all the questions that the sport is faced with, particularly with the issues faced around sports classification, training modalities and over-reaching to name a few. What I am keen to focus upon is educating the coaches with how meaningful physiological markers can be for performance optimisation.

Summary

Paratriathlon has just made its Paralympic debut in Rio 2016 and, like many other endurance sports, competitions can take place in thermoregulatory challenging environments. Research is rich regarding methods of heat adaptation via acclimation or acclimatisation however there are potential issues that may limit their applicability to elite athletes building towards competitive performance. As such, we trialled a novel method of heat acclimation in a group of British paratriathletes, consisting of active and passive heat exposure that drew on recent literature. The results of the protocol were promising and highlight just one example of how research may be translated and employed by sports science practitioners. This may be particularly pertinent as we now look towards Tokyo 2020 and the high ambient temperatures and humidity that athletes are likely to face and as practitioners look for strategies to manage the thermoregulatory strain in competition. ■

Ben Stephenson

Ben is a second year PhD student at Loughborough University, part funded by British Triathlon. His research focuses on physiological aspects of paratriathlon.

Prof Vicky Goosey-Tolfrey FBASES

Vicky is Professor and Director of the Peter Harrison Centre for Disability Sport at Loughborough University. She is a BASES accredited sport and exercise scientist.

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Exercise as medicine is much more than can be SAID

Prof John Saxton FBASES is the new physical activity for health columnist for The Sport and Exercise Scientist.

Students of exercise science soon become familiar with the *principle of exercise specificity*, which is one of the tenets of exercise physiology. Also known as the *SAID Principle (Specific Adaptations to Imposed Demands)*; its key message is that the body adapts in a specific fashion to the specific demands that are placed on it. Early in my career, as I started to apply my knowledge of exercise physiology to improving health outcomes, I could see the importance of this principle in optimising exercise for different populations: e.g. a middle-aged woman wanting to engage in exercise to help maintain bone mineral density or an elderly claudicant wanting to walk further without pain. At the same time, I also became aware of the complexity of health as a construct, and the wide-ranging 'spin-off' health benefits (positive side effects) that are frequently experienced when exercise is used as an adjunctive treatment for long-term conditions. To some individuals, these *non-specific* 'spin-offs', including systemic physiological adaptations and positive psychosocial health benefits, seemed to be as valuable to health as the more *specific* physiological adaptations we (as exercise scientists) might be looking for in our research, such as improved bone turnover or skeletal muscle metabolism.

Examples of non-specific systemic effects include vascular adaptations in sites distal to those that were involved in the exercise training, such as the cross-training effects observed between arms and legs (Tew *et al.* 2009) and systemic anti-inflammatory responses (Gleeson *et al.* 2011). Systemic adaptations can have far-reaching implications for exercise programme design and cardiovascular risk management. From the psychosocial perspective, evidence of an improved ability to cope with a chronic condition and a shift in *locus of control* is often plain to see in those with long-term conditions who engage in exercise. The latter is profoundly meaningful and provides a feeling that through exercise it is possible to have some level of personal control over a chronic condition and longer-term health. In addition, group-based exercise can be an excellent platform for social support in cancer populations, providing an opportunity to do something positive with others who have been through a similar experience - and this can be valued much more than traditional support groups (Emslie *et al.* 2007; Bourke *et al.* 2012). Psychosocial 'spin-offs' are wide-ranging and can be difficult to measure with standard tools.

How can an improved understanding of these 'spin-off' health benefits be used by exercise scientists and practitioners? Well, knowledge of the non-specific responses and adaptations to a particular form of exercise can help us to design adaptive exercise programmes that provide the necessary systemic stimulus for optimising health benefits but with much less pain. An appropriate example is using aerobic arm exercise to improve oxygen delivery to painful atherosclerotic legs (Tew *et al.* 2009), while simultaneously reducing markers of low-grade inflammation (Saxton *et al.* 2008). From the psychosocial perspective, an improved understanding of meaningful consequences that have resulted from engaging in an exercise programme could help to inform exercise counselling strategies for given populations, with the overall aim of promoting sustainable behaviour change. We know that a major challenge to implementing exercise within patient care pathways is proving its cost-effectiveness in relation to other treatments or standard care - and there is a need to think laterally about optimising the impact of scalable resource-limited health interventions.

So, although the *SAID principle* has an important role to play when exercise is being used therapeutically to ameliorate the impact of chronic disease, improve quality of life and survival, it is not the whole story. Furthermore, the growing problem of age-related multiple co-morbidities in the modern era presents this fundamental tenet with new challenges. For example, how can the *SAID principle* be used to meet the *specific* needs of a prostate cancer patient who, because of his hormone treatment, is sarcopenic and at elevated risk of cardiovascular events? Does it dictate a staged approach to exercise programming or a strategy geared towards combining different exercise modalities from the outset?

Because health crosses discipline boundaries, there is clearly a need for multidisciplinarity and a greater emphasis on mixed method approaches (e.g. qualitative methods informing and enhancing the knowledge gained from clinical trials) if we are to understand the broader benefits of exercise in different populations. What the SAID principle leaves unsaid may be more important to some individuals, and particularly those with disabling conditions or terminal illness. Rather than being a means to an end, exercise can then become an end in itself: a focus for something meaningful and a pillar of support. ■

Prof John Saxton FBASES

John has been researching the important role that physical activity plays in the prevention and management of chronic non-communicable diseases for two decades. He is a BASES accredited sport and exercise scientist.

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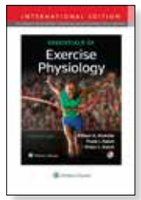
Reviews - books and apps

Social Psychology of Sport and Exercise. Linking Theory to Practice
Knowles, A-M., Shanmugam, V. & Lorimer, R. (2015).
Palgrave
Paperback £26.99

This book adds to the growing body of texts devoted to the issue of social psychology in sport and exercise over recent years, which recognise the significance of social situations within the field. It addresses clearly a range of social aspects of behaviour, including coach-athlete relationships, team cohesion, parental support, socialisation and exercise adherence in terms of key theoretical concepts and models. Where this differs to other texts is in addressing each aspect in relation to particular settings in sport, exercise and health. In the first half, sport settings provide the context including training, team settings and support networks. The second half moves onto exercise and health contexts including schools, the workplace, gyms, healthcare settings and outdoor activity environments. Each chapter follows the same structure including the application of the concepts and models addressed to a case-study in each particular environment, ending with potential interventions. This text would be valuable reading for undergraduate sport, exercise and health students, and for practitioners across the range of settings addressed, including coaches, PE teachers and instructors. The case studies could also be utilised by lecturers to develop students' problem-solving skills by focusing on the social situation in a variety of professional contexts.
PETE HOLMES, UNIVERSITY CENTRE DONCASTER
Rating 9/10



Essentials of Exercise Physiology. 5th edition
McArdle, W.D., Katch, F.I. & Katch, V.L. (2015).
Wolters Kluwer
Paperback £29.66 and Kindle £65.26

I first read this book during my undergraduate degree and from the latest edition it is evident why this text is a stable of undergraduate reading. It underpins all aspects related to exercise physiology with underlying theory and practical implications of training, nutrition, energy transfer, along with health issues which are impacted by exercise. This text covers the whole spectrum of work that the body does to perform exercise, with balanced research on areas that may not be clear cut. The *A Closer Look* sections really relate key topics into their practical applications and give further insight on current topics. Interactive material is also a great advantage of the latest edition, bringing principles to life with visual understanding. The animations really bring to life the scientific concepts and enables understanding from a visual perspective. Although training recommendations are perhaps limited, this text should be seen as the basis of knowledge from which training principles can be taken and employed in real-world scenarios. I would fully recommend this book as a key text for undergraduate students to give them a platform of underlying knowledge on which to build throughout their careers.
NICK ADKIN, COVENTRY UNIVERSITY
Rating 8/10

ACSM's Research Methods
Armstrong, L.E., & Kraemer, W.J. (2015). (Editors)
Wolters Kluwer
Paperback £37.80 and Kindle £35.91

This is a book aimed at graduate students and active researchers. It is an outstanding resource; detailed, comprehensive and well referenced. Its main readership I suspect will be those already well-versed in technical aspects of research, who are looking for additional support to tactical decisions around essential aspects of the research process. In 23 densely written, but accessible chapters there is a great deal of attention paid to the technical issues of, particularly experimental research. Practical issues around gaining funding, ethical approval and getting published are also well covered. I particularly liked the final chapter looking at how scientists can engage more effectively with the media and general public. I do have two criticisms: the text has a very narrow focus on empiricism. There is no real effort to broaden out the issue of knowledge construction into epistemology, ontology and axiology. This, in my view further serves to entrench opinions around what research is and what it's for. The second criticism concerns the emphasis on null hypothesis significance testing. There are the briefest of mentions of the magnitude based statistics that researchers are increasingly adopting. Overall, I have no hesitation in commending the book.
TONY WESTBURY Ph.D EDINBURGH NAPIER UNIVERSITY
Rating 8/10

App Name: **Stronglifts 5×5**
App Developer: **StrongLifts**
App Cost: **Free**
Download at: **Apple App Store or Google Play**
Devices: **iPhone or android**

This app provides a simple and effective workout for building muscle and burning fat. The app has a clean and straightforward layout that is quick to use and doesn't slow workouts down, it focuses on five compound exercises performed 3 days per week. The selected exercises are back squat, bench press, overhead press, barbell row and deadlift and are separated into an optimal order to achieve the greatest gains while avoiding overtraining. The app includes instructional videos for each of the exercise detailing correct form as well answering some frequently asked questions. The built in timer for timing rest periods is a particularly good feature as it allows me to stay focused on mentally preparing for the next set and not on the time. The 5x5 programmes have been scientifically proven to work for gaining muscle and increasing strength and therefore, users can be safe in the knowledge they are following an extensively tried and tested workout. Overall, I'd recommend this app to anyone who is serious about their weight training or just starting out and I look forward to future versions of the app. Full review: www.ourmobilehealth.com/#login
JAMES HICKMAN **Rating 4.4/5**

BASES members can find relevant apps to their field, read reviews and review by visiting **www.ourmobilehealth.com/#login**

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Industry supported postgraduate study

Prof Craig Twist explores the benefits and the barriers associated with industry supported postgraduate projects in sport science.

Funding of postgraduate students by sports organisations has become increasingly popular. Despite opportunities for knowledge transfer, research impact and employability, several challenges must be addressed to ensure the success of this type of project.

The opportunities

An industry supported postgraduate project typically brings together a student, an academic institution(s) and an industry partner. These collaborations present numerous opportunities for those involved.

For the student such projects present the financial support in terms of tuition fees and, in most cases, a stipend. Research conducted with coaches and athletes in a performance environment also provides the potential for original data that contributes to knowledge and enhances the quality of the final thesis. Finally, such projects provide the student with important training by developing fundamental practitioner skills and exposure to the cultures and practices within performance sport.

Funding for sports performance is proportionally much less than that received for health-related research (Research Excellence Framework, 2014). Accordingly, academics with an interest in researching sports performance must identify appropriate funding sources to meet the costs associated with such work. The recruitment of postgraduate research students provides a model to conduct research that also contributes to the institute's research environment. Moreover, these projects often target specific applied problems the result of which might be investigations with impactful outcomes that contribute to future research assessments.

For the industry partner such arrangements enable a cost-effective appointment of a dedicated staff member to work on identified projects. A research-led approach offers improved organisational performance from better resources and knowledge transfer from academia. In a recent editorial, Coutts (2016) outlines the benefits of embedding research scientists into high-performance sport to compliment the work of the applied practitioner. Compared to the 'front of house' practitioner who works directly with athletes and coaches, the research scientist might operate indirectly to provide an evidence-based approach that improves the practices of those within the organisation.

The challenges

Despite the opportunities, industry supported postgraduate study is not without its challenges. Any research conducted by the student must conform to the appropriate qualities and standards for research degrees (e.g. QAA UK Quality Code for Higher Education). While researching elite athletes typically presents a novel contribution to understanding, research rationalised solely on this basis is likely to be insufficient for a postgraduate study. The student and the supervisor(s) must ensure that any empirical work maintains the highest possible standards of academic rigour, is methodologically robust and provides an original contribution to knowledge in the area of interest. Similarly, the industry partner must appreciate the required academic standards and that the workplace provides an appropriate environment to support and facilitate postgraduate learning. Along with the lead institution, industry partners should ideally be involved from the outset in key processes such as the project proposal, interview, progress meetings, drafting of ethics applications and thesis chapters. To protect all parties these projects require clearly defined partnership agreements that detail funding and procedural arrangements pertinent to: i) expectations and requirements of the student, institution and partner; ii) formal evaluation procedures of student progress with relevant time scales; iii) strategies and restrictions on dissemination of data; iv) complaints and appeals. Those involved in setting up these type of projects should also refer to the *BASES position stand on curriculum-based work placements in sport and exercise sciences* (Board *et al.*, 2014).

The success of research projects conducted in an applied setting is dependent on overcoming several barriers. Firstly, practitioners' and athletes' perceptions and understanding of sport science are likely to influence the extent to which they engage with the research process and researcher(s) involved (see Martindale & Nash, 2013). Anecdotally many coaches and athletes are more willing to engage with research when they perceive tangible benefits for themselves and minimal disruption to their normal routine. Failure by the researcher to engage with the practitioner and athlete is likely to limit the quality of any proposed intervention and the work produced. Therefore, those seeking to research in sport must understand the context of their work within the bigger picture of the organization's overall performance and the work of others. This requires industry-specific knowledge and communication skills to translate information in a way that practitioners and athletes understand. Finally, expectations that the research outcomes will ultimately influence real-world practice need to be considered against the lack of empirical evidence to support such claims. Adopting an applied research model as proposed by Bishop (2008) might help in facilitating better outcomes from the collaboration between sport science and practice.

Summary

Postgraduate studentships embedded within a professional sport environment offer the opportunity for enhanced student employability, collaboration between academics and industry, impactful research, and enhanced applied practice. However, a number of challenges must be met to ensure research quality and its translation to real-world practice. The student, institution and partner might wish to consider some of the points presented in this article to facilitate a better experience and a positive outcome for all involved. ■

Prof Craig Twist

Craig is Professor of Applied Sports Physiology at the University of Chester. Craig has successfully supervised several postgraduate student projects in collaboration with organizations such as The Rugby Football League, individual Super League clubs and The England Handball Association.

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Research Excellence Framework 2014: Overview report by Main Panels and Sub-Panels 16-26, Jan 2015. Main Panel C Report, Sport and Exercise Sciences, Leisure and Tourism, pp. 114-121.

How do personal values influence sport behaviour?

Dr Jean Whitehead FBASES discusses values in sport.

Introduction
Unethical behaviour is a growing concern in sport. The Schwartz (1992) value theory provides a paradigm for exploring value-conflict through an understanding of interactions between *value systems* (personal priorities) and *values structure* (correlational relationships). Pertinent values can then be selected for interventions to develop pro-social or other values.

What are values and why do they matter?
Values are central beliefs about which goals or actions are most preferable. They are important because they guide judgments, decisions, attitudes and behaviour. They are relatively stable and they transcend situations, hence they have a widespread influence on human conduct. Values are studied widely across the social sciences, and have been examined in sport by my late BASES colleague, Martin Lee. He developed internationally valid and reliable measures of sport values and ethical attitudes to explore new relationships in a neglected field (see Whitehead *et al.,* 2013).

What is a value system and why should it be understood?
A value system is the ranking of individual values on a continuum of their relative importance for an individual or group. Figure 1 illustrates a youth sport value system across five nations. The red bars show that these competitors valued 'achievement' by improving their performance more than they valued winning, which was still important. The green bars show some moral values had high priorities.

The function of values systems should be understood because competitors behave differently according to their value priorities. For example, using the Youth Sport Value Questionnaire-2 (YSVQ-2) of Lee *et al.* (2008) I have found that those who reported relatively higher moral values (e.g. fairness) and lower status values (e.g. winning) than their peers were less accepting of cheating and gamesmanship attitudes than those with the reverse value profile.

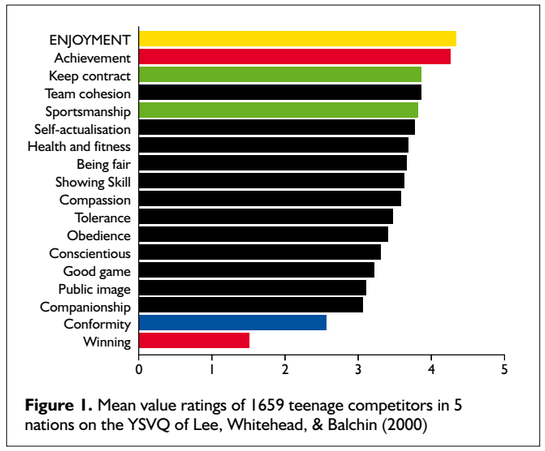

Figure 1. Mean value ratings of 1659 teenage competitors in 5 nations on the YSVQ of Lee, Whitehead, & Balchin (2000)

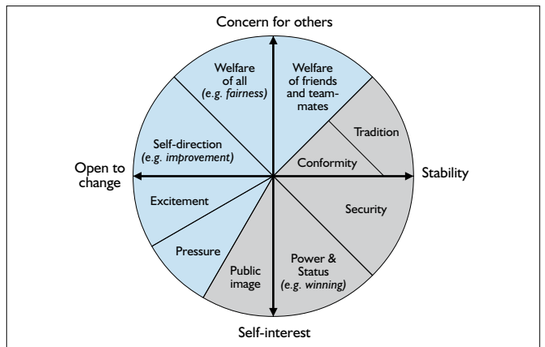

Figure 2. An adaptation of the Schwartz value structure for sport (Lambert, 2013)

How are values structured and what does this mean for practitioners?
Human values were grouped by Schwartz (1992) according to their motivational content. He used a multidimensional scaling method, based on correlational relationships, to derive a circumplex structure bisected by two orthogonal axes. This illustrates conflicting, compatible and neutral relationships among the values, and their location has now been validated in over 60 nations. Figure 2 shows an adaptation of the model for sport.

Sport scientists and practitioners can consult the model to select pertinent values for interventions. For example, the vertical axis contrasts values of self-interest with values of concern for others. It shows that winning conflicts with fairness. However, self direction (or personal improvement) on the left is compatible with fairness and is the logical value to encourage to promote fairness, particularly as Figure 1 shows that personal achievement ranked higher than winning in the value system.

How can values be taught through sport?
The University of Brighton's Football4Peace programme teaches values through soccer in divided societies (Whitehead, Telfer & Lambert, 2013). The horizontal axis in the circumplex model contrasts values of security and stability with values of openness to change, hence the programme promotes values selected from the shaded area in figure 2 to break down suspicions. Specifically, values of respect, responsibility, trust, equity and inclusion are taught by coaches who are trained to facilitate-observe-reflect-reinforce. The coaches set some situations to promote cooperation and others in which disagreements are likely. They then identify the desired responsible behaviours among the players and discuss and reinforce them in a cool-down period.

Summary
In the context of cheating and doping scandals, value theory enables practitioners and researchers to:
1. Understand how differing value priorities influence behaviour
2. Select compatible rather than conflicting values to emphasise in any intervention. ■

Dr Jean Whitehead FBASES

Jean is an Honorary Research Fellow at the School of Sport and Service Management, University of Brighton (Eastbourne campus) following official retirement. She was invited to submit this article as a winner of a BASES International Conference Grant.

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BASES Fellowships

The following individuals have been awarded BASES Fellowships this year. The award recognises esteemed professional achievement, skills, knowledge and service to BASES and the sport and exercise science community.

Dr Stuart Beattie is one of the Co-directors at the Institute for the Psychology of Elite Performance at the School of Sport, Health and Exercise Sciences at Bangor University. This year he was the organiser for the BASES student conference 2016 hosted at Bangor University, which attracted over 250 delegates. He has authored/ co-authored 20 publications (containing over 30 studies) in high quality peer reviewed research journals. Stuart is a Health and Care Professions Council registered Sport Psychologist and has worked with elite level athletes in British Gymnastics and the England and Wales Cricket Board.

Dr Claire Hitchings has been the Executive Director at the British Association of Sport and Exercise Sciences since 2003. She has been an active member of BASES since graduating in 1993 with a BSc (Hons) in Sport Science; attending and presenting at the annual conferences, attending and running BASES workshops and attaining accreditation and then supervising others. She initiated and co-authored the BASES Position Stand on Graduate Internships and is the editor of The Sport and Exercise Scientist. Since 2014 she has organised the BASES Annual Conference.

Prof Colin Boreham is the Director of the Institute for Sport and Health, University College Dublin. Following postgraduate studies at California Berkeley and Queens Belfast, he spent the remainder of his career in Ireland, North and South. He has published extensively, hosted the 1995 BASES conference in Belfast and served on the 2001 Research Assessment Exercise panel. He has retained his interest in elite sport (he held the British record for the high jump and competed in the 1984 Olympics as a decathlete) and was fitness consultant to the Ireland Rugby team for 3 years.

Prof Louis Passfield has worked both as an applied sports scientist and an academic. He has worked as lead sports scientist with the highly successful British Cycling team preparing for a number of major events including 1992 Barcelona, 1996 Atlanta, and 2008 Beijing Olympic Games. He has also coached Olympic, World Championship and Commonwealth Games cyclists, including the Great Britain team pursuit and England team time-trial teams. Louis has given invited lectures on his applied sports science and research work in the UK and at international conferences.

Dr Peter Brown was appointed Head of Performance Knowledge at the English Institute of Sport in 2012. He is a BASES accredited sport and exercise scientist and a former member of the BASES conference Scientific Programme Committee. His current role at the English Institute of Sport is to optimise the knowledge capability of the Institute in order to maximise performance enhancing solutions to sports by accelerating problem solving and decision-making by facilitating the capturing and exploiting of performance knowledge and expertise within multi-disciplinary practitioner teams.

Dr Charles Pedlar is a Reader of Applied Sport and Exercise Science at St Mary's University, Twickenham. He has been an avid supporter of BASES, has been re-accredited twice and won the BASES Practitioner of the Year in 2014. He has supervised a number of practising sport scientists to achieve their accreditation, and serves on the Lab Accreditation Committee. He has provided sports science support to various Olympic and Professional athletes through the British Olympic Association, the English Institute of Sport, and more recently Orreco and St Mary's University.

Prof Ian Campbell is Professor of Exercise Physiology and Deputy Vice-Chancellor at the University of Hertfordshire. He is engaged in all strategic and operational decisions that underpin the positioning and success of the University. He has an international research reputation relating to the 'physiology of the spinal cord injured athlete' with a strong track record of research outputs and invited presentations. He has been a professional member of BASES since 1988 and undertaken a variety of roles, most recently as Chair between 2012 and 2015, a position he feels very privileged to have held.

Dr Paul M. Smith is a Senior Lecturer at the Cardiff School of Sport, Cardiff Metropolitan University. He has been a BASES professional member for more than 25 years and has always contributed to BASES through regular annual conference participation, publishing and reviewing manuscripts for the Journal of Sports Sciences, co-organising and delivering a BASES workshop and various symposia. He has contributed to a BASES expert statement and is embarking upon a number of interdisciplinary, community-based projects with two prominent military charities, Help for Heroes and the Royal British Legion.

Dr Stewart Cotterill is a Reader in Sport and Performance, and Head of Department at the University of Winchester. He has published multiple books and numerous articles. His consultancy work has seen him work with a wide range of athletes and teams. He is a BASES accredited sport and exercise scientist and has served BASES in a number of ways including: as a supervised experience supervisor, contributing to the Division/ special interest group in sport and exercise psychology, the Awards committee, the BASES-BPS liaison committee, and has helped review submissions for annual conferences.

Prof Keith Stokes is Professor of Applied Physiology at the University of Bath. He is an Editor of the International Journal of Sports Medicine and is on the Advisory Board for the Nutrition and Biochemistry section of the Journal of Sports Sciences. He was Research Representative for the Division of Sport and Performance (2005-2007) and was Chair of the local organising committee for BASES Conference 2007 held at Bath. He is also Deputy Chair of the Scientific Programme Committee for the BASES Conferences 2017 and 2018. ■

Building a reflective practice evidence-base: investigating the benefits of enhancing reflective skills on the practice behaviours of health practitioners

Gareth Picknell, Dr Brendan Cropley FBASES, Prof Stephen Mellalieu and Prof Sheldon Hanton examine the relationship between reflective skills and practitioner effectiveness measures.

Introduction

Becoming a reflective practitioner is regarded by many as an essential developmental process for achieving and maintaining professional competence (Mann *et al.,* 2009). Advocates assert that the emergence of reflective practice is part of a change that acknowledges the need for applied practitioners to act and think professionally as part of their ongoing learning, yet ensuring the integration of theory and practice from the outset (Knowles *et al.,* 2014). However, whilst this is viewed as a positive movement towards enhanced professionalism, the evidence-base to support the efficacy of reflective practice is largely theoretical, with limited empirical investigations available. Indeed, it is noted that whilst there currently exists a prominent empowerment agenda within the sport, exercise and health disciplines, which encourages practitioners to take ownership of their self-evaluations, the art of reflection is still largely neglected. As with other domains, the resistance to 'buy-in' to reflective practice may be a result of a lack of confidence regarding the benefits for improving practice effectiveness (Picknell *et al.,* 2014).

The evidence, albeit limited, for the benefits of reflective practice is promising, with research suggesting that reflective skills are: 1) developmental in nature; 2) associated with enhanced learning; and 3) can result in improved cognitions, decisions and behaviours within a practical context. With these purported benefits in mind, and in attempts to enhance the confidence of practitioners for using reflective practice, Mann *et al.'s* (2009) call for more rigorously designed empirical research that will allow the field to evaluate the effect of different educational strategies to promote its development, appears to remain timely.

Study background

In an attempt to add to the empirical literature that has examined the impact of reflective practice on practitioner behaviours, a study was conducted as part of a nationwide preventative health programme delivered in the Middle East (Asia). As part of the health practitioners' preparation a competency-based professional training programme was developed. To determine the key elements of the training programme, a cross-examination of professional requirements for various health professions was carried out, which indicated numerous commonalities in terms of the competencies required to provide effective practical support. One area that was consistent, as well as transferable, across domains (e.g., Association for Nutrition; BASES; Health and Care Professions Council) was the need for professionals to continually review and self-evaluate their practice. Specifically, across all professional requirements for these professions is the need for practitioners to develop their critical reflection capabilities. As a result, and in attempts to ensure that training was commensurate with internationally recognised standards, a reflective practice intervention was administered with all staff involved with the preventative health programme.

Study aims

1. Develop an empirical evidence base within the sport, exercise and health domains that supports the usefulness of reflective practice.
2. Examine the developmental nature of reflective skills.
3. Examine the relationship between reflective skills and practitioner effectiveness measures.

Intervention

Participants were dieticians (n = 20) employed within a preventative health department. They were randomly assigned to one of two groups, with both groups being involved for the entire duration of the 22-week reflective practice-training programme. The reflective practice intervention was divided into three phases with each phase including a treatment and control period. In total, both groups were exposed to three reflective practice treatments and three control periods, alternating between these conditions until they had completed all phases of the intervention. The three reflective practice treatments adopted numerous approaches for facilitating the level of reflection (e.g., descriptive to critical) as part of a multi-modal approach to developing reflective skills:

- Phase A - educational workshops.
- Phase B - individual tutorials and mentoring.
- Phase C - action learning groups.

Measures and analysis

Process measures (i.e., Reflection Questionnaire; Reflection-in-Learning Scale) were used to assess alterations to participants' reflective skills following their involvement in the reflective practice intervention. Differences from pre- to post-intervention, as well as whether changes were attributable to the various reflective practice treatments were examined through a series of 2 (group) x 3 (treatment type) MANOVA's, with repeated measures on the second factor.

Outcome measures (i.e., DIET-Comms & Dieticians' Interviewing Rating Scale, DIRS) were used to evaluate whether practice behaviours (e.g., interpersonal communication and interviewing skills) changed as a result of developing reflective skills, and thus whether the participating practitioners became more effective across the course of the study. To achieve this, a series of 2 (group) x 2 (time) MANOVA's, with repeated measures on the second factor were performed.

Key findings

The key findings suggest that developing practitioners' abilities to reflect on their practice has benefits associated with improving the effectiveness of their service delivery. This conclusion is drawn from two data collection phases relating to: 1) the process of developing reflective skills, and 2) changes to practice behaviours. First, the results indicated that the intervention had been successful in improving participants' reflective skills, as scores for each scale improved from pre- to post-intervention (see Table 1). Whilst positive it is worth examining what factors contributed to the enhancement of reflective skills. On closer inspection improvements to reflective skills appeared to accelerate during the latter phases of the intervention. Conversely, minimal improvements were noted at the end of Phase A (educational workshops).

Table 1. Comparison of process-measure scores between data collection time points

Scale	T1-T2	T2-T3	T3-T4	T4-T5
Reflection-in-Learning Scale	-4.52 (3.24)*	3.79 (2.86)*	9.17 (4.57)*	5.13 (3.21)
RQ Reflection Scale	3.65 (2.44)	2.48 (1.41)*	6.55 (2.85)*	-6.16 (2.86)*
RQ Critical Reflection Scale	0.39 (1.94)	11.93 (8.52)*	2.31 (1.64)*	-8.11 (3.11)*

NB: T1 = Pre-intervention; T2 = Phase A of intervention; T3 = Phase B of intervention; T4 = Phase C of intervention; T5 = Post-intervention; * = significant difference ($P < 0.0125$).

Table 2. Comparison of outcome measures from pre- to post-intervention

Scale	Baseline (T1)	Post Intervention (T5)	T1-T5
DIET-Comms	22.85 (5.83)	25.47 (3.44)	5.45
DIRSRA	1.76 (0.44)	3.28 (0.48)	131.11*
DIRSQS	2.19 (0.38)	3.68 (0.38)	158.88*
DIRSCO	2.05 (0.60)	3.65 (0.81)	44.74*
DIRSOR	2.00 (0.67)	3.85 (0.57)	75.60*
DIRSTR	2.15 (0.75)	3.95 (0.83)	46.66*
DIRSPIEd	2.46 (0.61)	3.80 (0.33)	138.84*

NB: T1 = Pre-intervention; T5 = Post-intervention; * = significant difference ($P < 0.05$).

This finding suggests that individuals tend to perceive greater engagement with dimensions of reflective thinking when they can relate their immediate reflections to lived experiences. Indeed, this was more likely to be the case during Phase B and C of the intervention where participants were encouraged to reflect on critical incidents relating to their professional practice that they were exposed to whilst participating in the study. It appeared that their engagement with reflective thinking was as a result of their utilisation of a more structured approach to reflective practice, as well as their regular interactions with mentors, peers and clients that promoted self-appraisal of practices and outcomes, discussion of practice strategies and decisions, and attainment of feedback aligned to their goal-directed behaviours.

Focusing on the results of the outcome data (see Table 2) the changes to practice behaviours (e.g., communication and interviewing skills) following the reflective practice intervention appeared to be associated with enhanced reflective skills. Specifically:

1. Findings reported some improvements in the use of communication skills by the dieticians (DIET-Comms), which are considered essential for practitioners' to assess, diagnose and treat diet related issues.
2. The efficacy of the participants' interviewing skills, which are deemed vital for practitioners' to develop a more holistic understanding of their clients, improved from pre- to post-intervention.

Development in these practice behaviours are important for dieticians because clients' goals, lifestyle, eating habits, cultural values, knowledge and attitudes, and other characteristics must be defined accurately in order to develop successful treatment plans. In addition, evidence exists to support an association between appropriately applied communication/interviewing skills and patient satisfaction and compliance with clinical advice.

Key messages for reflective practice interventions

- Reflective practice interventions should not focus primarily on practice outcomes. Harnessing reflective skills in a meaningful way as part of the process is shown to facilitate knowledge and understanding about professional practice that is likely to bring about positive changes if required.
- Multi-modal interventions provide a range of strategies for engaging individuals in the reflective process, rather than relying on a 'one-size fits all' approach. As a result, endorsers of reflectivepractice need to be aware of an array of ways that they can engage individuals in quality reflections.
- Merely educating individuals about reflective practice does not provide them with the necessary opportunities to develop cognitive skills associated with reflecting. To promote reflective practice amongst practitioners, facilitators should consider approaches that challenge individuals' values, beliefs and attitudes. ■

Gareth Picknell

Gareth is Head of Health Promotion and Psychological Services for the UAE Armed Forces. He is a BASES accredited sport and exercise scientist and a Chartered Scientist.

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Prof Stephen Mellalieu

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Prof Sheldon Hanton

Sheldon is a Professor of Psychology and the Pro Vice-Chancellor for Research at Cardiff Metropolitan University. He is a Health and Care Professions Council Practitioner Psychologist and a British Psychological Society Chartered Psychologist.

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Re-accreditation - what's changed and why?

Kate Mills, the BASES Education Officer, provides an update on changes to BASES re-accreditation.

BASES is currently undergoing a review of its accreditation scheme. Within this review the re-accreditation application process has been streamlined while ensuring that applicants are able to maintain the standards required. The main benefit of the revised re-accreditation process is the ability to highlight specific areas of work and reflect on how these have benefitted an applicant's practice.

Re-accreditation is the process that individuals undertake to demonstrate that they continue to work at the required level attained for a BASES accredited sport and exercise scientist. It differs from accreditation as the applicant is not expected to demonstrate again how they meet the competencies required for accreditation. The revised re-accreditation process was successfully trialled in August 2016 and changes will be taking effect from 1 December 2016. Therefore, all applications for 6 January 2017 deadline need to use the new paperwork, available at: www.bases.org.uk/Re-Accreditation

Here is a guide to the five main changes.

1. Lapsed accreditation requirements
Members who have held BASES accreditation within the past 3 years are eligible to regain accredited status by applying through the re-accreditation process. The application should cover the previous 5 years of work up to the submission point. If BASES accreditation has lapsed for longer than 3 years the applicant will normally be required to submit a full accreditation application. Exceptional circumstances to the 3 year period will be considered on a case-by-case basis.

What's changed and why?
Previously, members whose accreditation had lapsed for *any* amount of time were required to submit a full accreditation application to regain accredited status. The revised re-accreditation process is now more flexible allowing for a 3 year break. Limiting lapsed accreditation to a 3 year period is important as accredited members must continue to meet a professional standard and once accreditation has lapsed, BASES is unable to monitor activity for that lapsed period.

2. Delivery log requirements
An overview is required of an applicant's delivery hours over the 5 year accreditation period. It is expected that s/he delivers at least 150 hours per year in the domain of expertise and this should be confirmed within this section. The applicant is also required to provide reflections on development as a professional over this time period.

What's changed and why?
An applicant is no longer required to provide a chronological list of specific delivery activities for the full 5 year accreditation period. Instead an overview is required of the activities carried out during this time with reflection on development. This allows the applicant to highlight their main activities to meet the criteria without needing to recall every activity over the 5 year period. It is also reinforced that changes in an applicant's role within a specific domain of expertise are acceptable (e.g. transitioning from a practitioner role to a supervisor or manager role).

3. CPD log requirements
An overview is required of CPD activities over the 5 year accreditation period. It is expected that the applicant undertakes at least 75 hours of CPD in the specialist area over this period.

If the specialist area changes within the accreditation period, i.e. changing from support to pedagogy, the CPD should reflect this. CPD should include activities in at least three of the following categories:

1. Work-based learning (e.g. supervising staff/students, reflective practice)
2. Professional activity (e.g. involvement in a professional body, mentoring)
3. Formal/educational (e.g. writing articles/papers, further education, workshops, conferences)
4. Self-directed learning (e.g. reading journals, reviewing books/articles)
5. Other (e.g. voluntary work, public service).

The applicant is required to provide reflection of personal and professional development over the 5 year accreditation period. Examples should be included of:

- How CPD activity has contributed to the quality of professional practice and service delivery
- How CPD activity has benefitted/impacted on the end users/client/beneficiaries of the work.

The applicant needs to provide a more detailed reflective account of one CPD activity per year.

What's changed and why?
The applicant is no longer required to provide a chronological list of specific CPD activities for the 5 year period. This allows the applicant to highlight their main activities to meet the criteria (i.e. 75 hours per year) without needing to recall every activity. There is also no need to reflect on every specific activity as with the prior tabular format. The applicant needs to provide an overall reflection of personal and professional development for the period, and then to select one activity per year for a more detailed reflective account.

4. BASES credits requirements
The applicant is required to gain 20 BASES credits allocated from a comprehensive list of BASES activities and externally endorsed activities carrying the BASES credits logo.

What's changed and why?
The quantity of required credits has remained the same; however, following member feedback, BASES now endorses other externally-related activities. Please refer to the BASES events page for activities carrying the BASES credits logo. There is now also more flexibility for overseas applicants, who are required to attain 10 BASES credits and 10 credits from equivalent activities with an overseas professional body.

5. Reference requirements
One reference is required from a BASES accredited peer.

What's changed and why?
It is no longer a requirement to provide three references. Instead, one reference must be provided by a BASES accredited member who can vouch for the applicant's work. ■

Kate Mills

Kate is the BASES Education Officer and studied Sport Science at the University of Brighton. Previously she worked as a Performance Officer, working with elite junior rugby league players.

Clinton Rubin testing the LIV on board a NASA KC-135 reduced gravity flight
Courtesy of Clinton Rubin

Vibration exercise: evaluating its efficacy and safety on the musculoskeletal system

Traditionally associated with negative effects on the human body, paradoxically, vibration is now being used to treat certain medical conditions and even protect astronauts from the physical effects of long-duration spaceflight. Here, an invited panel of experts review current evidence for vibration, examining its effectiveness and appropriateness as an exercise intervention.

Adam Hawkey: Head of Sport Science and Performance at Southampton Solent University and Chair of the BASES Division of Biomechanics and Motor Behaviour.

Vibration can be described as a mechanical oscillation characterised by periodic alteration of force, displacement and acceleration (Rittweger, 2010). Vibration exercise (VE), also commonly refered to as whole body vibration (WBV), can therefore be seen as a forced oscillation where energy is transferred to a resonator (i.e. the human body) from an actuator (i.e. a vibration platform). These platfoms usually operate in either a synchronous or side-alternating manner with the vibratory load dependent on three main parameters: frequency, the number of cycles of oscillation (Hz); amplitude, the displacement of the oscillatory motion from an equilibrium point (mm); and acceleration ($m.s^{-2}$), which determines the magnitude (Hawkey, 2012). The majority of WBV platforms operate in a frequency range up to ~60 Hz, peak-to-peak amplitude (or displacement) up to ~12 mm, and peak acceleration up to ~18 g (where 1 g = 9.81 $m.s^{-2}$). While most platforms are capable of exerting high loads, a low intensity vibration (LIV) device has been specifically designed to harness the musculoskeletal system's sensitivity to mechanical signals without necessarily putting it at risk to high loads or exacerbating an aberrant response to vibration; a known pathogen to a host of physiologic systems (Muir *et al.*, 2013). The mechanisms by which vibration exposure can affect the musculoskeletal and other bodily systems remains the topic of much debate. Some advocate stimulation of neuromuscular pathways and muscle spindles, increased muscle temperature and hormone secretion. Others propose that there is a more direct effect on cells, rather than a secondary one, with cells responding to perceived mechanical signals; directly influence fate selection in stem cells, for example.

Jörn Rittweger: Head of Space Physiology, Institute of Aerospace Medicine, German Aerospace Center (DLR) and Professor, Department of Pediatrics and Adolescent Medicine, University of Cologne.

Prevention of musculoskeletal deconditioning through the use of vibration exercise

Loss of muscle mass, strength and power, loss of bone mass and strength, and loss of tendon stiffness can all be summarised under the umbrella of musculoskeletal deconditioning (MSD). As such, MSD is frequently observed in older and elderly people, and also in astronauts when they return from spaceflight missions (Hawkey, 2003). During the past two decades, space agencies worldwide have commissioned bed rest studies (notably using young test participants) for the development of countermeasure exercises against MSD during spaceflight. The evidence currently available from these studies demonstrates that it is possible to effectively counteract MSD with appropriate physical exercise during bed rest, so long as these exercises involve forceful muscle contractions (i.e. resistive type of exercise) and are performed on a daily basis (Rittweger et al., 2010; Buehring et al., 2011). Combination with WBV (side-alternating, 19-30 Hz) significantly enhances the effectiveness for bone (Belavy et al., 2011), but not so much for muscle. In isolation (e.g. without additional loading) WBV appears to have no, or only very limited, effectiveness against MSD during bed-rest (Zange et al., 2008). In the ageing population there is now ample evidence supporting WBV's usage against MSD, with improvements reported in lower extremity muscular power, walking speed, and chair rising power (Bautmans et al., 2005; Hawkey et al., 2016). In addition, WBV reduces body sway and improves balance both at young and old age. Collectively, these effects should be expected to reduce the risk of falls and fractures, although this has yet to be demonstrated in large randomised controlled trials.

Prof Clinton Rubin: SUNY Distinguished Professor and Chair, Department of Biomedical Engineering, Stony Brook University, Stony Brook, New York.

Exercise is perhaps the single 'intervention' recognised as a deterrent to systemic diseases such as osteoporosis, sarcopenia, diabetes and obesity, yet the manner in which mechanical signals inhibit their pathogenesis remains unknown. Brief (<20 min) daily periods of high frequency (30-90 Hz), low intensity vibration (LIV < 1g) are anabolic to both bone and muscle (Rubin et al., 2001; Xie *et al.*, 2008) and safely serve as a surrogate for the spectrum of low-level mechanical signals provided by muscle activity; which decays with ageing and disuse. Exposure to LIV signals generates bone strain in the lower appendicular skeleton of < 10 microstrain (0.001% strain), at least two orders of magnitude below those generated in the weight-bearing skeleton during walking (Luu *et al.*, 2009a); crucially, LIV is therefore considered safe by ISO advisories for human tolerance levels for up to 4 hours each day. Clinically, LIV has provided some protection to the musculoskeletal system even under severe challenges such as the menopause, chronic bed rest, Crohn's Disease, Adolescent Idiopathic Scoliosis, Duchenne Muscular Dystrophy, child cancer survivors, children with disabling conditions (e.g. Cerebral Palsy), and young women with osteoporosis. Reductions in subcutaneous, visceral and marrow fat in mouse models of diet-induced obesity (Luu et al., 2009) have been a surprising finding with exposure to LIV. The starkly distinct response of these tissues (↑bone & muscle; ↓fat) to LIV suggests that these signals influence the differentiation pathway of mesenchymal stem cells (MSCs) (Uzer *et al.*, 2015). Translated to the human, this could help explain why a sedentary lifestyle is permissive to both osteoporosis and obesity, seemingly distinct diseases, and could suggest that LIV reduce adipogenesis and strengthen the musculoskeletal system as much by defining the fate of MSCs as influencing the resident cell population within bone, muscle or fat (Chan, Uzer & Rubin, 2013).

Concluding remarks

Vibration has been successfully utilised to counteract musculoskeletal deconditioning, reduce age-related performance decrements and treat a range of conditions. While this has fuelled interest from scientific and medical communities, concerns continue regarding the efficacy and safety of vibration exposure. Discerning between the effects of synchronous and side-alternating WBV and also fully interpreting the progress being made with LIV will be critical in understanding how different bodily systems respond to different vibratory signals. Standardising the reporting of variables will also be crucial with regard to ensuring safe practice and in the furthering of research techniques and treatment parameters. ■

Above: Adam Hawkey instructing Soyeon Yi (South Korea's first astronaut) on a synchronous WBV platform
Courtesy of Adam Hawkey

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Blackcurrant intake: making headway as an ergogenic aid!

Prof Mark Willems describes why nutritional interventions were undertaken with New Zealand blackcurrant. He expects that the findings on the effectiveness of New Zealand blackcurrant at rest and during diverse exercise modalities will contribute both to the growing interest in applications of functional foods in sport and exercise sciences and the future development of innovative sports nutrition products.

Introduction - value in anecdotal information

In 2011, the Netherlands National Triathlon Elite Team disclosed the intake of New Zealand blackcurrant powder as a nutritional ergogenic aid as part of their training programme, reporting that it seemed to enhance recovery. Public sharing by elite athletes of nutritional ergogenic practice is uncommon. The disclosure in 2011 did seem to be ignored by academics with an interest in sports nutrition, as evidence-based studies to support New Zealand blackcurrant as an ergogenic aid were limited.

What evidence was out there and why the interest in New Zealand blackcurrant?

Blackcurrant is considered a superfruit with a high anthocyanin content compared to other berries. Anthocyanins are the pigments responsible for the variety of colours of berries. Berries differ substantially in anthocyanin composition with blackcurrant containing four main anthocyanins: cyanidin-3-O-glucoside, cyanidin-3-O-rutinoside, delphinidin-3-O-glucoside and delphinidin-3-O-rutinoside, those four making up ~87% of all phenolic compounds (Cyboran *et al.*, 2014). The anthocyanins contribute to the anti-oxidant and anti-inflammatory properties of berries. Regular berry intake is known to provide significant health benefits. In addition, berry intake may reduce exercise-induced oxidative stress with beneficial effects during exercise and recovery.

Blackcurrant is not commonly consumed as a fresh fruit and mainly grown to be processed for food additives or blackcurrant products. The first study on the acute effects of a powdered extract made from New Zealand blackcurrants was conducted by the New Zealand institute of Plant and Food Research. The study suggested potential health implications for individuals undertaking regular exercise (Lyall *et al.*, 2009). Five males and five females (age range 37 to 63 years) performed a 30-min row at an intensity of 80% $\dot{V}O_{2max}$ with intake of capsulated blackcurrant powder (a total anthocyanin intake of 240 mg) before and after exercise, with blood samples taken before, 1, 2 and 24 hr after exercise. The blackcurrant extract suppressed oxidative stress parameters, e.g. the protein carbonyl levels, immediately after exercise. No observations were reported for effects of blackcurrant on physiological and metabolic responses during the exercise. Interestingly, observations during typing work in humans with a blackcurrant concentrate revealed an increase of peripheral blood flow by 22% (Matsumoto *et al.*, 2005), suggesting the potential for effects during exercise for anthocyanin-containing fruits and berries. However, studies on the effects of anthocyanin-containing fruits and berries focused on the post-exercise effects (e.g. montmorency cherry juice: Bowtell *et al.*, 2011; Lyall *et al.*, 2009). An ability of blackcurrant to reduce exercise-induced oxidative stress combined with enhanced blood flow provided a physiological rationale for addressing the effects of blackcurrant during exercise.

What we did and what we found

Dosing strategies for many popular ergogenic aids, e.g. creatine and caffeine, are well established but are, as yet, unknown for blackcurrant. With support and input from stakeholders, we supplemented trained triathletes with New Zealand blackcurrant powder for 7 days, an intake of about 110 mg anthocyanins a day. We recognise that with any new nutritional intervention, an examination of potential mechanisms for any effect is key to explain meaningful physiological, metabolic or performance effects. Our focus was applied with all studies having a randomised, double blind, cross-over design to examine effects of New Zealand blackcurrant intake. We aimed to establish whether New Zealand blackcurrant would alter the physiological and metabolic responses during exercise as well as influencing the cardiovascular responses at rest.

Thirteen trained triathletes with >3 years' experience (8 men, age: 38±8 years, body mass: 71±9 kg, BF%: 19±5%, mean±SD) performed two incremental cycling protocols with recording of physiological and cardiovascular responses. During an incremental cycling protocol, the lactate responses were substantially lower at intensities from 40% to 70% of maximum power with a maximal decrease of 27% at 40% (see Figure 1), indicating a downward and rightward shift of the lactate curve. A shift of the lactate curve is a common observation after an endurance training programme. Maximum oxygen uptake, maximum power and maximum heart rate were not different by intake of New Zealand blackcurrant powder during an incremental cycling test to exhaustion. However, at exhaustion, lactate values were 14% lower with New Zealand blackcurrant. New Zealand blackcurrant intake had no effect on cardiovascular responses during exercise. However, cardiovascular function at rest was changed with an increase in cardiac output by 26% and a decrease in total peripheral resistance by 16%, suggesting enhanced blood flow at rest that may benefit exercise recovery.

Our findings provided for the first time the evidence that a product made from berries was able to have meaningful effects during exercise. As far as we know, the shift of the lactate curve was not shown before with a nutritional intervention in endurance trained individuals. The lower lactate response could be due to changes in the energy contribution of carbohydrates and lipids, and suggesting enhanced fat oxidation. In a follow-up study using a New Zealand blackcurrant extract for 7 days (an intake of about 110 mg anthocyanins a day) with 13 endurance trained males cycling at 45%, 55% and 65% of $\dot{V}O_{2max}$, fat oxidation was enhanced up to 27% at 65% (Cook *et al.*, 2015). In the same study, we also showed that time trial performance for 16.1 km was improved by 2.4% (see Figure 2) and this was comparable to the increased performance time with an acute dose of beetroot juice (i.e. 2.7%) as observed by the work of Prof Jones and colleagues at the University of Exeter (Lansley *et al.*, 2011).

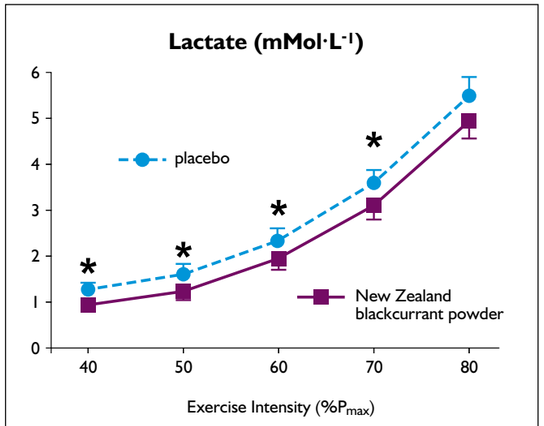

Figure 1. Lactate responses during cycling at different exercise intensities. Exercise intensity was expressed as a percentage of maximum power (%P_{max}). *, difference between placebo and New Zealand blackcurrant powder. Data are mean±SD.

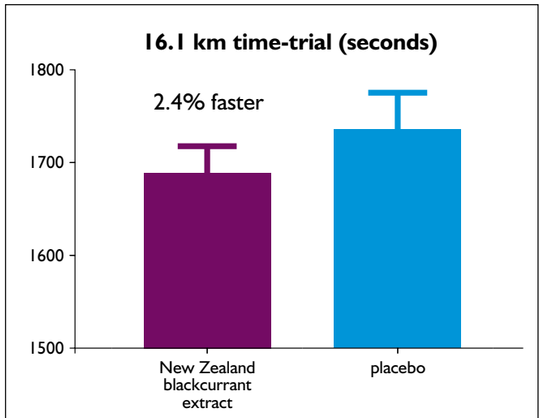

Figure 2. Time of the 16.1 km cycling time-trial. Data are mean±SD.

In another laboratory-based study with 7 days intake of the New Zealand blackcurrant extract, 13 active males (age: 25±4 yrs, $\dot{V}O_{2max}$: 56±4 mL·kg^{-1}·min^{-1}) performed a treadmill running protocol to exhaustion. The protocol consisted of stages with 6x19 s of high-intensity running with 15 s of low-intensity running between the 19 s runs. The rest time between the stages was 1 minute and stages were repeated with increasing sprint speeds (Perkins *et al.*, 2015). The treadmill running protocol was an adapted intermittent treadmill running test to examine running ability in soccer players. We observed that New Zealand blackcurrant intake increased the total running distance by 10.6% from 3871±622 m to 4282±833 m with the distance of the high-intensity runs to be increased by 10.8%. At exhaustion, lactate values tended to be higher (NZBC: 6.01±1.07 mmol·L^{-1}, placebo: 5.22±1.52 mmol·L^{-1}), which may suggest an increased tolerance for high lactate values. In addition, in a field-based study with a sport-specific test in males, the New Zealand blackcurrant extract reduced slowing of the maximal sprint during the Loughborough Intermittent Shuttle Test (Willems *et al.*, 2016). During the 5th 15-min block in the Loughborough Intermittent Shuttle Test, slowing was 0.06 sec with New Zealand blackcurrant extract and 0.12 sec in the placebo condition. Our observations on the effects of New Zealand blackcurrant intake on the metabolic responses during exercise and enhanced performance for endurance cycling and repeated high-intensity running in addition to the ability to reduce slowing of maximal sprints indicate implications for exercise over a broad range of intensities and durations.

What next?

It will be challenging to design studies to examine the mechanisms for the effects of blackcurrant intake during exercise. Intake of an anthocyanin-containing supplement results in complex bioavailability of anthocyanins and metabolites. It is likely that the synergistic actions of the metabolites on cell function and fatigue mechanisms need to be understood. In addition, an enhanced understanding of the applied effects of anthocyanins and mechanisms on in vivo exercise and recovery would require manufactured cocktails of specific anthocyanins controlling amount and type, but for now costs to create such cocktails are problematic. Blackcurrant seems to contain a potent cocktail of anthocyanins with implications in sport and exercise sciences. More research is recommended to address, for example, the effects of blackcurrant intake on exercise in extreme environmental conditions, dose-response effects to establish dosing strategies, and the implications of blackcurrant intake for individuals with clinical conditions, e.g. peripheral arterial disease.

The future of berries in sport and exercise sciences

Research on the application of anthocyanin-containing products in sport and exercise sciences is in an early stage. Future studies will likely address the effectiveness of other berries: Will we see a competition of berries in sport and exercise sciences, and if so, which are the best? New Zealand blackcurrant has shown to be effective during exercise and recovery and is making headway as a new ergogenic aid with implications for active individuals enhancing the benefits of exercise performed for health, exercise training and competitive practice. The future for berry intake by athletes seems to be bright. The scene has been set by New Zealand blackcurrant. ■

Prof Mark Willems FECSS

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Silver Athena Swan award: an example of how

Dr Lisa Price and Dr Sarah Jackman outline departmental initiatives implemented as part of the application for an Athena SWAN silver award.

In the winter 2015 issue, the Sport and Exercise Scientist published an article by Dr Tracey Devonport FBASES (Devonport, 2015), raising awareness of the Athena SWAN charter in the BASES community. The article provided an outline of the submission requirements, including a demonstration of critical self-assessment and planned/implemented initiatives to address key issues. The University of Exeter holds a bronze Athena SWAN award and in 2014 the Sport and Health Sciences department were proud to achieve a silver Athena SWAN award. As our departmental working group prepares for the upcoming re-submission for the silver award, we believed this to be a good opportunity to follow on from Dr Devonport's article by sharing the main issues we identified and how we introduced positive changes to the workplace for students and academics.

For those unfamiliar with Athena SWAN, the charter was established in 2005 to facilitate increased participation of women in Science, Technology, Engineering, Medicine and Mathematics (STEMM) throughout higher education, focusing particularly on progression through academia and career milestones and creating a positive working environment. Focused on 10 key principles, the charter encourages institutions to embed gender equality values into their policy and culture. Institutions and departments can apply for a Bronze, silver or gold award. Those applying for bronze awards must demonstrate foundations for the elimination of gender bias and the development of an inclusive culture. Demonstration of activity and achievement for the promotion of gender equality, and building on previous achieves, should be demonstrated for a silver award; whilst Gold awards can be achieved through the demonstration of continued activity and achievement of gender equality promotion and the embedding of Athena SWAN principles throughout the institution. (Equality challenge unit; http://www.ecu.ac.uk/equality-charters/athena-swan/about-athena-swan/ retrieved 16.09.2016)

Our initial application for the Athena SWAN silver award was made in April 2014. The first stage of the process was to acquire and analyse quantitative and qualitative data to identify areas where intervention might better support and encourage participation of female scientists. To do this, we formed a working group of mixed sexes and grades to identify issues central to the Athena SWAN remit. This group utilised data on staff and students gender ratios throughout the department. Areas of analysis included student recruitment at each level of study, award classifications, academic and research staff ratios, recruitment, career progression and staff turnover. We established that the department gender ratios compared favourably to the benchmark values for undergraduate (benchmark = 33%), postgraduate taught (benchmark = 36%) and postgraduate research students (benchmark=43%). We did however identify a downward trend in female representation within staff academic progression. Though in-line with national STEMM statistics (Kirkup *et al.*, 2010), data from our department demonstrated a distinct 'drop off' in senior roles, specifically at professorial level (see Figure 1). As a department we had 0% females at professorial level, whilst Kirkup *et al.* (2010) reported 9.3% full time and 8% part time female professors. Corresponding to this, we identified a distinct lack of female role models, for students and junior staff alike. For the purpose of this article, we will focus on these key areas.

To address the lack of female role models, the department set about developing a number of initiatives. As a department we were pivotal in developing a mentoring scheme 'one step beyond'. This initiative provides a formal arrangement for academic and research staff to volunteer as mentors to others within two academic grades of themselves. Using their own professional experiences, alongside specialised training in supporting the mentee, mentors act as a sounding board and offer impartial feedback. The programme is of mutual benefit to both parties as participation is recognised as professional development through academic citizenship. Whilst the scheme was originally developed for academic and research staff, given the integral role of professional services within our university, the scheme is currently under development to include staff that fall within the professional services remit. As a college wide initiative, 'one step beyond' directly addressed our key issue of lack of female role models; increasing the access to role models within and external to the department. A number of additional objectives were also addressed including, the provision of support around key career transition points, supporting career development opportunities for staff, providing good communication channels and opportunities to share and adopt good practice.

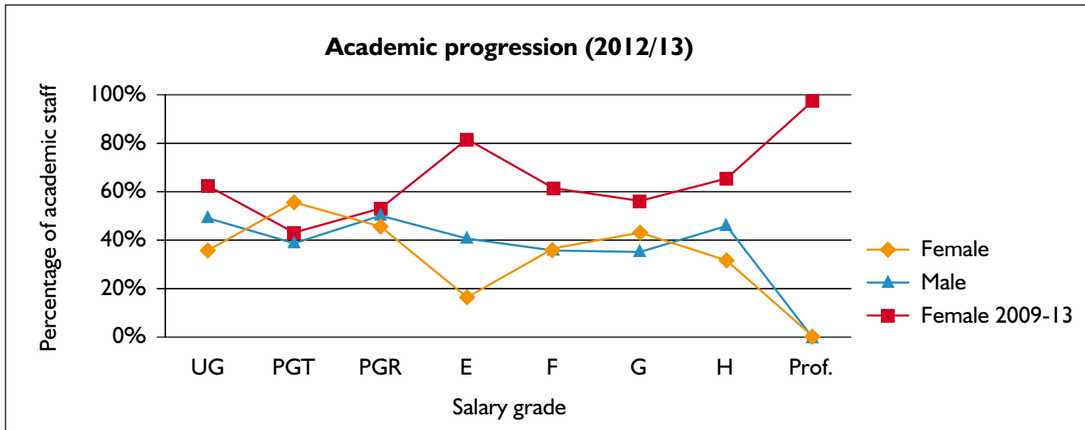

Figure 1. Percentage of staff through academic grades in Sport and Health Sciences at the University of Exeter.

The external presentation of positive female role models was also pursued through ensuring gender balance within outreach and student recruitment activities. For example, a balance of male and female student ambassadors and staff are actively involved at open days to answer questions to prospective students and parents. Additionally, we ensure that school outreach sessions are delivered by male and female postgraduate research students (PGRS). These instances provide a unique opportunity to present female role models at all stages of academic careers to prospective students.

As one of the Athena SWAN actions, the department created the 'Early Career Research Network' (ECRN) aimed at PGRS, postdoctoral researchers, research fellows and academics on lectureship posts. The network, currently organised by two early career female lecturers provides research skills training and social activities to create a supportive environment for those at the initial stages of their career. Focus groups utilised at the beginning of each academic year collate opinions on training requirements. These needs are then met through in-house delivery, or are out-sourced to other university departments or external partners. The inception of an annual PGR conference day that falls within the remit of the ECRN also allows PGRS to receive feedback from academics outside of their immediate supervisory team and encourages development of presentation skills in a supportive environment. In addition, these presentations also encourage discussion and collaboration opportunities between research groups.

Feedback within the ECRN led to a number of workshops being provided based on career progression, equality and diversity, unconscious bias and skill development. Since the introduction of the ECRN, it has managed to target a number of our key objectives; the network was specifically designed to target postgraduate student support and provide support around key career transition points. Yet it also aids career development opportunities for staff and provides good communication channels and opportunities to share and adopt good practice. Specifically, at one workshop two recently promoted members of staff discussed the intricacies of their advancement, and gave advice on the university's 'Exeter Academic' progression pathway. Seminars such as this ensure all staff are aware of promotion criteria and they encourage more junior staff to ensure that they acquire relevant skills and experience to develop themselves as strong academics. Furthermore, promotions workshop are run annually by the Pro-vice-Chancellors, HR business partner and Head of Department and are open to all staff and PGR students. In addition to in-house seminars (e.g. analysis techniques, statistics workshops), staff are also encouraged to attend centrally run workshops as part of their career development. Two such courses that particularly encourage the development of confidence and leadership are the 'Springboard' and 'Navigator' courses, for women and men respectively. Both courses aim to help staff develop their full potential, with self-directed objectives that can help participants achieve work related goals, undertake new qualifications, deal with stress or gain a healthier work life balance.

(Springboard consultancy; http://www.springboardconsultancy.com/courses/springboard/. Retrieved 20/09/16)

One of our key initiatives to encourage women into higher academic positions is to ensure more junior staff are exposed to leadership and management roles. Currently there is a balance of males and females in leadership roles within the department, leading initiatives such as ECRN, widening participation events, Chair of Athena SWAN working group, Course director for undergraduate and PGT programmes and Head of Department. These roles are often rotated to allow staff to gain experience in a number of roles; supporting career development opportunities for staff. Additionally, the presence of female role models has increased due to the appointment of two prominent senior academics with honorary research contracts.

These initiatives represent just a handful of the overall initiatives outlined in our full Athena SWAN application action plan and are provided as examples as to how Sport and Health Sciences at the University of Exeter aimed to improve the working environment and create a more gender balanced department. As noted, these actions were put in place due to the identification of few female role models and a lack of senior female academics, yet the impact has been further reaching. As we head into the next submission, the department is reflecting upon the success of our previous action plan, and drawing on evidence to support our subsequent application. The writing of this article has aided the committee in doing just this, and we hope that it has provided some insight into the initiatives undertaken to achieve an Athena SWAN silver award. For those that are interested in learning more about the submission our previous application can be found on the Equality Challenge Unit website.

Commentary - Dr Tracey Devonport FBASES

This article presents important step forwards in both publicly illustrating efficacious Institutional initiatives and maintaining awareness of the need for Athena SWAN. However, isolated Institutional gains alone will not secure the wider cultural change necessary to meet and maintain the equality of career opportunity and uptake objectives of Athena SWAN. As a profession we must seek to work collaboratively and proactively to ensure that careers in sport and exercise are equally viable for aspiring early career males and females.

As a mother of two small children I recently came across a fabulous resource intended for children that has a clear message for us adults! (https://www.facebook.com/cbeebies/videos/10186144015071957/ retrieved 3.10.2016). Children (aged 5-7) were asked to draw a picture of a firefighter, pilot and surgeon and to give them a name. The overwhelming majority of children (male and female) drew these career associated individuals to be male with a male name and identity. Then entered into the classroom a female firefighter, female pilot and female surgeon - the children looked visibly shocked!

If asked, how might children draw a biomechanist, physiologist and psychologist? If we are to truly enact change, we need to challenge implicit gender assumptions at all ages. BASES and its membership, the gauntlet is thrown down. How we might address career equality is up for debate, one which I hope we as professionals all partake in. ■

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True grit - we all have choices: a Paralympian's journey to the 'roof of Africa'

James Wright, Thomas Smith, Gary Witty, Louis Langdown and Scott Burnet reflect on the multiple experiences of those involved in supporting a Paralympian's attempt to reach the summit of Mount Kilimanjaro unaided.

Introduction

Standing at 5,895 m, the summit of Mount Kilimanjaro, Tanzania, is the highest point in Africa. The ascent is physiologically and psychologically challenging for any non-acclimatised or non-physically conditioned individual. Although the physiological demands and mountaineering skills required to reach the summit are significantly less than higher mountains such as Everest (8,496 m), the effects of Acute Mountain Sickness (AMS) are felt by many who make the summit. Symptoms of AMS include loss of appetite, severe headaches, persistent coughing and presyncope (dizziness). Whilst 25,000 people make the ascent to the summit of Mount Kilimanjaro each year, the rugged terrain and intermittent climbs make the trek a challenge for anyone who is not physically able to manoeuvre the trails, let alone someone who is confined to a wheelchair. This case study documents the physiological support provided by a staff-student sports science team for a Paralympian and his ascent to the summit of Mount Kilimanjaro in aid of the Meningitis Research Foundation (MRF) and Shaw Trust.

In March 2016, Aaron Phipps, a wheelchair rugby Paralympian who competed in the London 2012 Games approached the sports science team at Southampton Solent University to ask for support in his attempt to become the first wheelchair bound individual to reach the summit of Mount Kilimanjaro unaided. Only a handful of wheelchair bound individuals have reached the mountain's summit in the past with all receiving 'significant' assistance due to the topography of the mountain trails. Aaron had worked closely with the Sports Science team in the lead up to the London Games and so when he asked what we thought of the challenge, our responses were mixed, but there was a collective agreement that Aaron had the resolve to succeed. Having survived meningitis when he was 15 years old, but subsequently losing both legs from just below the knee as a consequence of the illness it was never in doubt that Aaron possessed the mental resilience to complete the climb.

Above: Aaron Phipps celebrating his ascent to the summit of Mount Kilimanjaro Courtesy Aaron Phipps

Staff perspective

Whilst sports science support forms an integral part of what we do, there is a demand for providing work-based learning (WBL) opportunities for students. With real-world experience and employability becoming a key initiative within UK Higher Education Institutions (HEI's) (HEA, 2012) it was believed that this would be an excellent opportunity for our undergraduate and postgraduate students to apply their scientific knowledge and to enhance their employability opportunities by gaining experience through working with a 'live brief' (Doggart *et al.*, 2014).

The current case study provided a unique opportunity for a group of students to deliver sports science support under supervised conditions. Such an opportunity would require students to contribute to the planning and delivery of a physical conditioning programme in a real-world environment. Nevertheless, there is a balance to be struck as staff have a duty to ensure that the students working with clients are sufficiently competent and capable to undertake such work (Brodie & Irving, 2007). It is therefore imperative that students are provided with opportunities as part of taught undergraduate and postgraduate degree courses to help them develop both technical, as well as softer skills (e.g. communication skills, critical thinking, etc.).

Students from our undergraduate and postgraduate courses who were interested in the opportunity were encouraged to email a CV and a statement detailing why they were interested in the position. Whilst we wanted to encourage students to apply from across the undergraduate and postgraduate courses, it was important to recognise that the candidates needed to possess a critical level of physiological and strength and conditioning based knowledge and experience. Two students were selected from the courses within the Sports Science and Performance programme. The first was an undergraduate student (Gary) studying on the BSc (Hons) Applied Sports Science degree and the second was a postgraduate student (Tom) on the MSc Athletic Development and Peak Performance degree. Both had gained experience of working with athletes in Southampton Solent University's High Performance Academy.

The students performed two principles tasks. The first was to conduct a detailed needs analysis of the physical requirements Aaron was likely to utilise during the ascent. The second was to liaise with Aaron to ascertain his training history, availability to train and types of exercises he would be able to perform. The information they collected was then presented to staff before a strategic approach to the conditioning programme was proposed and agreed.

Biomechanical support was also provided once the wheelchair had been delivered. The Mountain Trike on-off road wheelchair (Mountain Trike, Cheshire, UK) uses a lever drive system to propel the chair and was customised to negotiate rough terrain. Although limited information was available, variations in hand position were proposed to assist in the recruitment of different muscle groups and to reduce the impact of peripheral muscular fatigue. To achieve this, extra horizontal bars were welded onto the original bar to provide these two positions.

Clearly defined roles and responsibilities were established for both staff and students. Weekly meetings were held to discuss what had been achieved during previous week and to identify any concerns we had with Aaron or the conditioning programme (e.g. struggling to respond to the training stimulus). Based on the outcome of the meeting, the team would then adapt the objectives set for that week to maximise the training response and minimise the likelihood of injury.

Student perspective

The purpose of the pre-testing programme was to screen for physiological strengths and weaknesses and to assist in the formulation of a training programme. Muscular strength, range of movement (RoM) and aerobic capacity ($\dot{V}O_{2max}$) were identified as the physiological parameters that would yield the greatest performance effect in the time permitted. The responsibility of testing and training was divided between the two students with one focusing on RoM and muscular strength, whilst the second focused on aerobic conditioning.

Tom

The area of expertise that I brought to the team was very much from the field of strength and conditioning. I had completed a placement at a county academy cricket team and really wanted to be part of this opportunity as it involved working with a phenomenal athlete who had represented Team GB at the London 2012 Paralympic Games. In addition, it was the unique challenge of helping to prepare someone to climb Mount Kilimanjaro in a wheelchair. It's not every day that you hear the words 'wheelchair', 'Mount Kilimanjaro' and 'as fast as I can'. My brief was to help develop RoM and muscular strength and so I used a functional movement screening (FMS) protocol to determine trunk RoM whilst upper body one repetition maximum tests (1RM) were used to determine muscular strength. The main objective was to ensure that Aaron could minimise the risk of injury throughout the ascent by strengthening the muscles needed to complete the challenge. With his mountain specific strength training involving a high volume of horizontal pushing, the focus was on the maximum strength side of the exercise continuum. This involved the use of low repetition, heavy compound exercises including the bench press, rows, military press as well as other accessory exercises. One of the key challenges was working out the most effective means by which to perform the exercises with Aaron being in or out of the wheelchair. Strength work was supplemented by improvements in trunk mobility, trunk strength and trunk anti-rotation by using a variety of bands, cables and medicine balls. These sessions typically lasted for 1 hour, twice per week.

Gary

I had worked closely with the local wheelchair rugby team and so was aware of Aaron and his achievements. Whilst the physical demands of the ascent were quite different from what I was used to, I was encouraged by the sports science staff to apply the knowledge that I had gained through the physiology modules as part of my undergraduate degree. To prepare Aaron for the physical demands he would experience during the ascent I delivered a high intensity interval training (HIIT) programme, which incorporated both treadmill based and stationary arm ergometry exercise. The treadmill based training intensities were identified from both $\dot{V}O_2$ and blood lactate measures (i.e. threshold data) taken during a treadmill-based incremental exercise test. In contrast, the arm-ergometry exercises were associated with all-out maximal-bouts of exercise. To help mediate the effects of the reduced partial pressure of oxygen at altitude, exposure to hypoxic conditions was necessary. A resting, intermittent hypoxic exposure programme was developed using a portable hypoxic generator (Hypoxico Inc. NY, USA). This device would limit the amount of oxygen that Aaron would inhale (approximately 13-15%) with the aim of promoting physiological adaptations such as an increased volume of red blood cells and to help reduce the symptoms of AMS, but without compromising training under normoxic conditions. This protocol was recommended by the manufactures with the aim of evoking a 'live-high, train-low' styled approach. I would typically lead three, 1 hour sessions per week, which consisted of 3-5 min under hypoxic conditions (blood saturation between 80-85%) followed by 2-5 min under normoxic conditions. Aaron would then supplement this with 3 days acclimatisation on Mont Blanc, France (4,808 m) before flying onto Tanzania.

Aaron's perspective

The prospect of being the first wheelchair-bound person to complete the ascent of Mount Kilimanjaro without support had been a real allure as it gave me a platform to demonstrate what could be done, as opposed to what could not be done. It was the most physically challenging task that I had undertaken since the London Games and in some ways even more challenging due to the short preparation time and the added pressure of balancing work and family commitments.

Once I had been introduced to the students we set about discussing my testing and training needs. It was the first time that I had worked with a team of students who were basically administrating my training and whilst there were initial doubts, these were quickly dissipated as I was struck by their knowledge in their respective areas of expertise and how it could be applied to my situation. I was impressed by the patience that the students demonstrated as they listened, empathised and adapted their objectives to work around my personal circumstances. The sessions involved a combination of cardiovascular and strength based work, aimed at preparing me for the demands of the ascent.

Conclusions

Aaron completed the climb in 5 days, but compared the ascent to competing in 16 marathons back-to-back. Aaron's achievement was truly inspiring and testament to what individuals can achieve. He was the first to acknowledge the contribution made by the students. In addition, this challenge provided a very unique WBL opportunity for two students to apply the knowledge and skills learnt through their respective courses and gain real-world experience. ■

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Final Word with Dr Keith Tolfrey FBASES

Above: Keith with his brother and son before the England vs. Malta football game at Wembley.

Key people who inspired me

During my career in physical education and sport and exercise science, I have met and worked with numerous wonderful people and leaders in their field, including Professors Neil Armstrong, Les Burwitz, Clyde Williams and Stuart Biddle, who have inspired many of us. However, my daily and longer-term inspiration has come from my wife (Professor Vicky Goosey-Tolfrey) and my mum (Mrs Carol Tolfrey). Vicky inspires me because she is incredibly well-organised and efficient; she never pretends to be something she isn't and she has managed all of her success whilst raising our beautiful children and looking after me (I help too!) As for my mum, she decided to give exercise a go with a 1 mile run in 1985 (with 8 rest intervals). Since then, she has completed more road/cross-country races, open water swims, triathlons and cycling events than we could ever have imagined. Having a septuagenarian Mum who spends much of her time running, swimming or cycling with her Victory Athletic Club and Portsmouth Tri club-mates is inspirational for me.

One moment that changed the course of my career

I was 9 months into my first teaching job as a PE teacher at Sidmouth College in 1990 when I bumped into Professor Neil Armstrong whilst passing through the Exeter University campus (he was Head of the PE Department then, where I'd graduated the previous summer). Neil asked me if I was interested in applying for the vacant University Tutor position; I told him that I didn't realise there was a vacancy and, anyway, I was only 9 months into my teaching career and lacked hands-on experience! He said that wasn't a major issue - he felt I matched the criteria and should give it some thought. Twenty-six years later, I'm still working in Higher Education having spent 2 wonderful years at Exeter between 1990-1992 learning the ropes alongside some giants in sport and exercise science including Neil, Stuart Biddle and Ken Fox. This chance meeting with Neil, now a good friend and long-term mentor of mine, kick-started my career that shifted from PE to exercise science in the early 1990s.

One great thing that sport and exercise science has achieved

As a new science on the block, early and current generations of sport and exercise scientists have and continue to work hard to find a place amongst the longer standing natural, social and formal branches of science. I am not so naïve to believe that sport and exercise science is well-regarded universally and some still look down on us. Nevertheless, it is clear from the popularity of the study of sport and exercise right from GCSE PE, which has numerous sport and exercise components, through to PhDs and DScs, that our field has come a long way in a relatively short period of time. The ability to use elements from diverse sciences to address increasingly complex research questions, to better understand and enhance health and performance, is unique to sport and exercise science. Finding our critical niche is a great achievement, which should be recognised and celebrated.

One challenge that I think sport and exercise science faces

Answering this question has not been easy because there are many challenges - my earlier drafts related to young people, reflecting my research interest in paediatric health and performance. Then, I considered how we need to collaborate and support GPs in the UK to help them use physical activity to replace or compliment traditional pharmaceutical prescriptions. Finally, however, I decided that translating scientific findings into meaningful actions that have a realistic chance of enhancing health and well-being should be prioritised. This will need a multi- or interdisciplinary approach to support people with competing priorities and varied needs. My interest in science ranges from basic to applied, but I wonder how much of what we know or understand about the benefits of regular physical activity (or reduced sedentary behaviour) reaches the populations our samples are intended to reflect? Turning scientific results into actions is a challenge we all face.

A couple of proud moments in my career

Working in higher education means that I have been fortunate to experience proud moments regularly; most notably, this is through the achievements of the students I teach or support from BSc to PhD and beyond. Recently, Julia, Alice, Rachel and James (they know who they are) have all made me proud - they've made it fun to go to work. After scanning down the list of illustrious past BASES Chairs, I feel enormous pride in being elected to this position myself. Although this is mixed with a delicate hint of pressure, a pinch of angst and the occasional tiny frustration - the positive challenges override everything else.

One thing that I like to do on days off

I love doing things with my family when I'm not working - this includes coaching my son's U15 football team, running or cycling with them all, getting beaten at any card or board game (and being a very bad loser!) or having a belly-laugh together watching something like Modern Family. ■

Dr Keith Tolfrey FBASES

Keith is a Reader in Paediatric Exercise Physiology at Loughborough University and Chair of BASES.

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